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ABSTRACT

This study was undertaken to develop a taxonomy of conceptual objectives for use in planning programs of instruction related to environmental management (K-16) and to determine whether or not biases exist among persons representative of selected disciplines. Survey techniques to obtain and validate appropriate environmental management education concepts involved written questionnaires and personal interviews. Examination of 17 unacceptable concepts and the frequency of rejection of each provided little evidence to support any speculation of the existence of possible bias. The rating of the concepts does indicate an individual divergence of opinion and interpretation. Scholars from 40 professional areas and 12 ecological regions in the United States agreed on the majority of concepts to be emphasized in environmental management education. Topic organization represented a more useful structure of concepts than did the agrarian-focused conservation concepts and organizations existing in many public schools. (BP)

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ENVIRONMENTAL MANAGEMENT CONCEPTS — A LIST

REPORT FROM THE PROJECT ON PROTOTYPIC INSTRUCTIONAL SYSTEMS: SCIENCE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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The University of Wisconsin
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Technical Report No. 126

Environmental Management Concepts—A List,

By Robert E. Roth*, Milton O. Pella, and Clay A. Schoenfeld

Report from the Project on Prototypic Instructional Systems:
Science

Based on a Ph. D. dissertation by Robert E. Roth under
the direction of Milton O. Pella and Clay A. Schoenfeld

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April 1970

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STATEMENT OF FOCUS

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Prototypic Instructional Systems in Elementary Science Project in Program 2. General objectives of the Program are to establish rationale and strategy for developing instructional systems, to identify sequences of concepts and cognitive skills, to develop assessment procedures for those concepts and skills, to identify or develop instructional materials associated with the concepts and cognitive skills, and to generate new knowledge about instructional procedures. Contributing to these Program objectives, the Science Project is developing a taxonomy of concepts in the conceptual schemes environmental management and the particle nature of matter and is conducting research to determine the content, instructional, and learning factors influencing the level of sophistication attained by pupils in their study of those schemes.

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ABSTRACT

This study was undertaken to develop a taxonomy of conceptual objectives for use in planning programs of instruction related to environmental management (K-16) and to determine whether or not biases exist among selected representatives of disciplines and ecological regions relative to those conceptual objectives.

Survey techniques to obtain and validate appropriate environmental management education concepts involved written questionnaires and personal interviews. Responses were received from 350 of 699 (50.7%) members of a national panel and there were 111 of 128 concepts that met the criterion of acceptance by 90% of the respondents.

Examination of the 17 unacceptable concepts and the frequency of rejection of each on the basis of response by professional area or ecological region provides little evidence to support any speculation of the existence of possible bias. One concept was rejected by as many as 27% of the judges, while the remaining 16 concepts were rejected by 18% or fewer. The rating of the concepts does indicate an individual divergence of opinion and interpretation but no clear-cut bias is evident on the basis of either professional area or ecological region. Some causes for rejection on the basis of multiple interpretation or vagueness of the concepts were suggested.

Scholars from the 40 professional areas and 12 ecological regions in the United States agree on the majority of concepts to be emphasized in environmental management education. It is suggested that the topic organization used in Table 4 represents a more useful, appropriate structure of concepts than do the agrarian-focused conservation concepts and organizations existing in many public schools.

I
CONSERVATION AND THE CURRICULUM

INTRODUCTION

Throughout the ages of man a variety of civilizations have emerged and disappeared and all have been a consequence of the interactions of man and his environment. The civilizations have been dependent upon the nature and quality of the natural resources and also the ingenuity of the human resources present. Recorded history recounts many examples of changes in civilizations that were the result of man's ingenuity in developing natural resources and also many that were the result of his careless use of natural resources. With the development of more efficient methods of recording and transmitting the results of human experience has come a more extensive use of natural resources.

Chapman (1952) has stated that "We are the heirs of the experience of peoples who have lived on this planet for hundreds, even thousands of years." He also relates that great civilizations have had three elements other than man's virtue and ideals; namely, the primary physical basis for an abundant life, a technology, and an effective social organization. The interactions of these factors have resulted in civilizations or cultures that have been recorded as examples of environmental or human exploitation and degradation. Presently man is facing the problems of environmental quality that include a declining physical resource base, burgeoning population, and increased leisure time.

Dasmann (1968 a) has described the situation clearly:

> We live in a country that leads the world in economic production. We have an unprecedented standard of material well-being. We hear often that tomorrow's problem will be what to do with our leisure and that seems small cause for worry. Yet recently I checked with many of the leaders in my own field (ecology) and related areas concerned with man and his environment. Everywhere the same storm warnings were flying, the same belief that we are heading into a growing crisis. At best I found hope that we would change our course. More commonly I found the feeling that if luck held we would get by with some minor catastrophes, affecting the tens of millions rather than the hundreds of millions. If our luck still held we would then learn the lessons needed for survival.
>
> Why is there this discrepancy between our official attitude of well-being and optimism and this minority report from well qualified experts. Perhaps the answer lies in the ecological viewpoint shared by all whom I consulted. Ecology is concerned with interrelationships. These are out of balance.

When faced with this imbalance we can ask with Brandwein (1966): "What kind of education is relevant in this moment of history when comprehension of the fitness of the environment and the interdependence of environments, or organisms, and of men is essential to securing sanative environments and sane men?" Schoenfeld (1968 b) provides a partial answer:

> To support and sustain our search for environmental quality, we need new educational programs that will discover and disseminate the ecological and economic facts, engineering techniques, and esthetic appreciations basic to an applied conservation conscience.
>
> ...by becoming associated with particular pressure groups and specific methods, the term "conservation education" has tended to lose some of its viability as an approach to an integrated man-land ethic. Conservation

education lacks compelling theories of content and methodology; its concepts and materials are rooted in an agrarian era; it lacks practitioners of adequate background and scope; it is oriented to special "users" rather than to the environment itself. It has no clear-cut coordination, impetus, or funding.

The question of what our citizens should know about environmental management is prerequisite to the development of meaningful educational programs in this area for children and adults.

HISTORICAL BACKGROUND

Some of the more conspicuous developments in conservation or environmental management education date from the publication of the Third Yearbook of the National Society for the Study of Education (1904) in which the problem assumed the form of Nature Study. The philosophy of this movement was described by Jackman:

> The spirit of nature study requires that the pupils be intelligently directed in the study of their immediate environment in its relation to themselves; that there shall be, under the natural stimulus of the desire to know, a constant effort at a rational interpretation of the common things observed. If this plan be consistently pursued, it will naturally follow that the real knowledge acquired, the trustworthy methods developed, and the correct habits of observing and imaging formed will lay a sound foundation for the expansive scientific study which gradually creates a world-picture, and at the same time enables the student, by means of the microscope, the dissecting knife and the alembic, to penetrate intelligently into its minute details.

Comstock (1911) defined nature study as: "...a study of nature; it consists of simple, truthful observations that may, like beads on a string, finally be threaded upon the understanding and thus held together as a logical and harmonious whole." The teaching methodology of the Nature Study programs was based on principles of faculty psychology and the serial development of abilities and the content was designed with the objective of understanding the physical environment. Because of the attention to training the faculty of observation and the prevailing idea that the natural resource base was inexhaustible, little concern was noted for protecting or conserving the environment.

The nature study movement began to wane because of the excessive use of anthropomorphic procedures in teaching isolated facts at a time when pragmatists like William James and John Dewey were influencing education. This was the period when the concept that learning was largely dependent upon experience was emerging. It was also the time when Dewey (1916) was concerned with the concept that the generalizations and methodology of science may serve as a means of teaching science. Following the pattern of emphasizing a conceptual approach to learning, Craig (1927) viewed science education as a part of general education. The 1932 science curriculum suggested by Craig included four areas of study that were related to conservation: (1) kinds of living things; (2) changing earth conditions; (3) survival of plants; and (4) interdependence of living things and their environment.

The 46th Yearbook of the National Society for the Study of Education, Part I (1947, pp. 35-39) emphasized the wise use of natural resources as an important goal for education in a democracy and includes the statement: "Probably no child will study science without having his ideas and attitudes on such matters as health, citizenship, or conservation modified." Notable in the context of what contributions science may make to conservation was the work of Craig (1944) who described specific conservation practices and explained their importance to present and future human welfare. Explicitly, at this point in history, the curricular concern for conservation education was firmly established.

Recognition of the need for conservation education was probably the result of the identification of certain social and natural resource conditions within the borders of certain states, together with the contention that the curriculum should reflect social concerns of the day. An expression of societal concern for the depletion of forests, wildlife, soil erosion, loss of useable water, and exhaustion of high-grade mineral resources (Allen, 1955) was indicated in the school curriculum as early as 1921 in Tennessee (Lively & Priess, 1957). The teaching of some conservation principles was required by state legislation in Tennessee at that time and by 1944 eight other states passed similar legislation. A precedent that "conservation instruction must be included in the educational programs for teachers and/or required for certification" was thus established as was the requirement that "conservation instruction must be provided for students in the public schools."

The American Association of School Administrators 29th Yearbook (1951) was devoted to the promotion and development of ways to establish and implement conservation teaching in the school curriculum. A resolution by the American Association of School Administrators clearly illustrates the motivation and justification for the emphasis they gave to conservation education:

> Wastage of human and natural resources either by neglect or destruction robs society of its rightful potentialities for better living. In order to develop and conserve our human and natural resources it is recommended that renewed emphasis be given in school curricula to the wise use of natural resources, the development of the fundamental principles of moral character and responsible citizenship, and the preparation needed for everyday living as set forth in Education for All American Youth and Life Adjustment Education for Every Youth. (American Association of School Administrators, 1950.)

The National Association of Biology Teachers formed a National Conservation committee in 1954 and charged it with the task of formulating criteria for conservation objectives, activities, and materials. The need for such an approach was stated by Weaver (1955) in the handbook that was produced:

> Conservation is gradually becoming a way of life. More and more people are coming to accept the concepts of conservation and to govern their lives thereby. And yet, the number of our people who remain relatively unaffected by these concepts is distressingly large. How to help reduce this indifference to wise use of our natural resources is the purpose of this Handbook.

State committees, that served as coordinating agencies for the selection of exemplary conservation education materials and the involvement of many interested professional and lay groups as sources of conservation information, were organized by the National Conservation Committee of the National Association of Biology Teachers. Weaver (1955) edited a Conservation Handbook that was an attempt to promote the general acceptance of the criteria for conservation objectives by citing actual illustrations of appropriate teaching sequences already in existence. The suggested materials and activities for conservation teaching included in the Handbook have continued to be used by at least some conservation educators to the present time.

Hone (1959) conducted a nationwide investigation "of the causes of discrepancy between American thought and practice with regard to conservation education." The procedure employed included the analysis of printed curricula, textbooks, and tests used in conservation education (K-12). Conservation was then defined as "wise use, not saving," and it was determined from the analysis of the materials that a major emphasis on renewable resources—soil, water, plants, animals—existed while nonrenewable and human resources were virtually ignored. It was further stated by Hone (1959) that:

> ...although we give lip service to a concept of conservation that is far reaching in its effect on natural and human resources, we have focused conservation education on a narrow segment of this concept; namely, renewable resources. It is also evident that this almost complete disregard of resources other than renewables points to a serious lag between immediate conservation problems and educational interpretation of them.

The too-narrow view of conservation was thought to have little interest or appeal for the majority of citizens. The heavy emphasis on renewable resources at the agricultural level was cited by Hone as a problem:

> Conservation as presently conceived by most conservationists seems to have little relevance to the persistent life situations faced by the majority of our school children and their parents.

Recommendations for improving conservation education included the need for emphasis on problems in the child's immediate environment, a consideration of the resource needs of an industrial and highly urbanized society, and ways of meeting those needs. Hone (1959) also suggested that "further study is required to illustrate the place of conservation as a bridge between science and social studies."

Menesini (1968) reported on an environmental education program claimed to be appropriate for use with Grades 5 through 12 that uses the National Parks of the United States as an educational resource and laboratory. It is stated by Menesini (1968) that:

> A major goal of the NEED (National Environmental Education Development) program is to foster in children an appreciative and critical awareness of their environment, particularly an understanding of the interactions of natural and social processes as

illustrated in National Park areas. Its aim also is to increase their will and capacity to improve the environment.

A basic premise of this approach is that environmental awareness requires both classroom work and experience out-of-doors. As this program progresses materials continue to be prepared that are considered appropriate for pre-site (classroom), on-site (environmental school), and post-site studies. The first phase of the program deals with appreciation of natural phenomena and emphasizes development of academic, aesthetic, and skill relationships with the natural environment at a Fifth and Sixth Grade level. A second phase appropriate for the Seventh, Eighth, and Ninth Grades emphasizes the positive and negative ways man uses natural resources and the solving of contamination problems through applied technology. The third phase focuses on environmental ethics at the Tenth, Eleventh, and Twelfth grade levels with emphasis on the disciplines of political science, economics, and social science. The intent of the program as described by Menesini is to prepare interpretative materials for use as a supplement to the existing curriculum that highlight the interrelationships of man with his environment.

CURRICULAR PROCEDURES

There are several organizational patterns for environmental management education; special courses in environmental management may be developed (Weaver, 1955); environmental management concepts may be integrated into existing courses (Stapp, 1965); or there may be both special courses and course integration (Weaver, 1955). Presently the organizational preference among educators (Brennan, 1968) appears to be that of integration. The fact that environmental management concepts and practices include knowledge from the areas of science, social studies, the arts, humanities, medicine, and engineering, makes this procedure of integration especially suitable. Also in support of the integrated procedures it is cited that (Schoenfeld, 1968) environmental problems can be considered from a variety of points of view; concepts appropriate for an understanding of the problems may be drawn from the existing related academic areas in the curriculum.

Prior to the adoption of a procedural position there are several other needs to be satisfied if an effective program is to be developed: 1. The concepts important to an understanding of environmental management must be selected, 2. Opportunities for coordination of the selected concepts with the existing curriculum must be identified; and 3. The grade placement of the selected concepts must be determined. The concern of this report is the identification or selection of the important environmental management concepts that relate to scientific, social, humanistic, and technological disciplines. The process of identifying the conceptual content appropriate to the study of environmental management may thus begin by asking a variety of scholars: "What should a person know about environmental management education in order to function as an effective citizen?" In this procedure it is assumed that scholars from environmental management related disciplines will have informed opinions as to what concepts in and of environmental management should be included in the education of citizens and that they will be in essential agreement with each other. The recognized need and these assumptions served as the bases for this study.

II

THE PROBLEM AND ITS SIGNIFICANCE

THE PROBLEM:

To develop a taxonomy of conceptual objectives related to environmental management education for use in planning programs of instruction (K-16).

SIGNIFICANCE OF THE STUDY

This investigation is one attempt to provide a structure of important ideas that may be used by educators at school levels K-16 in developing educational programs in environmental management. The past programs have been agriculturally or recreationally oriented. The need for a reorientation from the agrarian to a more general resource-based approach to education is recognized by Yambert (1961):

> Although there is currently no universally acceptable definition of conservation, there is general agreement that its scope is wide and that it involves interrelationships, both among resources and among academic disciplines. Specifically, conservation is commonly acknowledged to include facets of the biological, physical, and social sciences. Thus conservation affords a somewhat unique conceptual approach admirably suited for emphasizing the important interrelationships among several fields of knowledge and also for integrating and applying the facts and valid generalizations for these fields to human affairs.
>
> Currently, however, the field of conservation lacks any systematic and comprehensive cadre of basic generalizations even remotely comparable to the "laws" of the physical sciences, the "axioms" of mathematics, or the "principles" of the biological sciences.

Yambert (1961) suggests three major groups of concepts: the ecosphere and its component parts; the nature of the various resource and resistance groups; and the pairs of conservation measures, integration-counteraction, augmentation-diminution, and allocation of resources and resistances. The focus, however, is upon the natural resource base, with man and culture being in secondary positions of importance and emphasis.

A list of principles and concepts desirable for use in secondary schools was prepared by Visher (1960). She identified 477 principles and concepts and classified them into nine categories: soils, water, forests, grassland, minerals, wildlife, recreation, human resources, and general conservation. She stated that: "This compilation will greatly aid in implementing a broad, well-balanced program of conservation rather than the traditional somewhat narrow, piece-meal approach to resource use." As can be observed from the categories of resources mentioned above, an agrarian focus and resource-oriented perspective is evident.

Hanselman (1963) attempted to develop a base of desirable conservation generalizations that would "...bring together the thinking of conservationists from many disciplines from all academic levels." The "disciplines" represented in this study included the traditional conservation areas of forest, agronomy, wildlife, botany, economics, geology, and geography. The analysis of the opinions of these scholars resulted in 152 statements and most had the traditional agrarian, rather than the "total environment," focus on natural resources.

White (1967) attempted to identify the educationally important conservation understandings and also those community resources that could be used in teaching the understandings. He first classified the understandings as: forest, soil, grassland, wildlife, air,

water, minerals, recreation, and general resources and then reclassified them as appropriate for field or classroom study. After careful examination of the 271 understandings White selected as being useful, it is clear that his conservation education orientation has the traditional agrarian focus. In addition, White observed that apparent differences of opinion existed in the ways that individuals within the areas of professional conservation and college teaching responded to the rating of concepts. It was recommended that these differences be explored further. It was suggested that understandings acceptable to conservationists and appropriate for various regions of the United States be developed.

The impending crisis in the environment that is described by Dasmann (1968 b) and the interrelationships of man with that environment that are suggested by Dice (1955) and Cain (1967) are important factors that must be considered if man is to survive into the Twenty-first Century. A different focus on environmental management is therefore needed: one which will bring man, the physical and cultural environments, and their interrelationships into a different structural organization for purposes of instruction and understanding.

This report is important because:

1. It will provide a list of conceptual objectives judged by a wide variety of scholars to be important to an understanding of environmental management. This kind of information is essential before a new instructional program can be developed.
2. It will provide some information about the biases experts from 40 professional areas and several ecological regions have regarding judgments relative to the importance of certain environmental concepts.

DEFINITION OF TERMS

The terms "environmental management education," "environmental education," "conservation education," "outdoor education," and "resource (or resource-use) education" are often used interchangeably and are hence confusing. For the purposes of this report the term "environmental management education" is to be used as defined below.

Environmental management education is the process of developing a citizenry that is:

1. knowledgeable of the interrelated biophysical and sociocultural environments of which man is a part;
2. aware of the associated environmental problems and management alternatives of use in solving these problems; and
3. motivated to work toward the maintenance and further development of diverse environments that are optimum for living (Stapp, et al., 1969), and also is aware of.

'Optimum environment'—Potter (1967) "one which ... induces each individual to develop continually from birth to death as a result of systematic challenges by physical and mental tasks which elicit normal adaptive responses within his rapidly increasing and eventually declining capabilities."

'Sociocultural environment'—social systems within which individuals and groups with different cultures participate and interact.

'Culture'—Goodenough (1966) "... the shared products of human learning."

"Biophysical environment'—the biological and physical aspects of environment with which man interacts and from which he obtains life supporting sustenance and natural resources.

'Management'—the intentional and rational manipulation of objects or events to achieve a predetermined end, goal, or objective.

III
RELATED LITERATURE

Although studies related to the development of concepts and principles for teaching have continued since the beginning of education, those concerned with conservation have been initiated only recently. One of the early studies conducted by Robertson (1935) was an attempt to determine the principles of science that were considered suitable as goals of instruction for the elementary grades. Graff (1962), however, suggested that investigators in conservation education from 1939 to 1950 were mainly concerned with the status of conservation teaching on a regional or national level. Since 1950 the main emphasis has been the development of multiple-choice tests for junior and senior high school students to determine the extent of their conservation knowledge. Few studies, to date, have been designed to identify conservation concepts, principles, or understandings for public school use. Those studies that have been attempted were within the traditional agrarian frame of reference to conservation described previously.

Since the studies related to the present report can be drawn from a broad range of types, selected studies will be considered in the following three categories:

1. Studies dealing with the development of conservation concepts;
2. The determination and organization of principles and concepts for teaching;
3. Status studies describing the development of conservation education curriculum programs.

DEVELOPING CONSERVATION CONCEPTS

Noteworthy among the few existing studies dealing with the development, validation, and organization of "principles," "concepts," "understandings," and "generalizations" for the teaching of conservation are: a study of conservation "principles and concepts" for secondary schools (Visher, 1960); an attempt to develop a different framework of conservation "principles and concepts" (Yambert, 1961); the development of a list of "conservation concerns" for the evaluation of interdepartmental conservation teaching at the university level (Hanselman, 1963); and an attempt to associate "conservation understandings" with community resources in a specific geographic region (White, 1967).

Visher (1960) attempted to determine those conservation principles and concepts desirable for secondary school students. An original list was developed by analyzing 15 conservation textbooks, 9 books for general reading, 2 special conservation issue journals, 1 reprint series, 5 professional publications for teachers, and 4 doctoral dissertations. The list produced was submitted to 11 specialists in conservation for refinement and critical analysis. The refined list was then submitted to 5 nationally recognized leaders familiar with instruction at the secondary level. The result of the study was a list of 477 concepts that included the following numbers of concepts classified by area: soil—85; water--56; forests—55; grassland—20; minerals—57; wildlife—51; recreation—37; human resources—38; and general—78. This attempt resulted in a considerable expansion of both the number and quality of concepts appropriate for conservation education.

While developing a framework of "descriptive and predictive generalizations" pertaining to the field of conservation, Yambert (1961) surveyed and analyzed existing studies of generalizations related to conservation teaching at the elementary and secondary levels. A broad range of professional literature in conservation and allied fields was included. The results consisted of 12 generalizations representative of those including the elementary and secondary schools and others selected to complement them. It was suggested that the

generalizations listed could serve as a basic framework adaptable to many situations in conservation education with application to other areas as well. With a basic structure so developed, Yambert suggested that other concepts and principles could be appended. Yambert's investigation represents a first attempt to develop a framework of generalizations in conservation that went beyond the agrarian orientation.

Hanselman (1963) investigated the scope of the conservation education afforded the majority of students at The Ohio State University. Specifically he measured the current status of interdepartmental conservation-related teachings presented through the large enrollment courses. Procedures included: (1) a literature review to develop a list of important conservation concepts and concerns which "should" be included in conservation education; (2) revision and correction of the list by 24 leading conservationists, e.g., economists, geographers, ecologists, agronomers, etc.; and (3) development of two survey instruments, an 18-page topic survey to determine the scope, and a 2-page opinion questionnaire to be used along with informal interviews with each of 54 cooperating professors. A list of 108 conservation-related topics was developed covering 15 areas: economic, ecological, socio-cultural, etc. Analysis of the results indicated that the professors had a keen interest in conservation education and concern for improving it. Another conclusion was that the conservation education received by most students in attendance was spotty and inadequate. Hanselman's investigation provides a basis for developing an effective conservation education program through interdepartmental approaches in that both the concepts developed and the apparent interdepartmental concern and interest in conservation education could be combined to implement a refocused approach to conservation education.

White (1967) sought "...to determine some important conservation understandings that might be desirable for conservation education in Grades 4 through 12," and "...to identify some community resources which could assist in the teaching of these conservation understandings." Related literature was examined and a list of understandings was developed and organized into nine resource areas for evaluation by people knowledgeable in each of the areas. The desirability of each resource area was rated by 30 people classified as teachers in elementary schools, secondary schools, or colleges, or as professional conservationists or interested resource personnel. Using a 5, 4, 3, 2, 1 rating scale, a mean score of at least 3.0 was used as the criteria for acceptance of the item. Of the 274 understandings evaluated: (1) 271 met the criteria; (2) all were associated with community resources in the geographic area in which the study was conducted; (3) 103 of the understandings were judged as appropriate for field study; and (4) 168 were appropriate for teaching in the classrooms. A marked individual difference in opinion on the majority of understandings was observed among professional conservationists and college teachers. It was also concluded that since 172 understandings were scored in the range from 1-5, conservation understandings more acceptable to conservationists were needed.

DETERMINING AND ORGANIZING PRINCIPLES AND CONCEPTS FOR TEACHING

Procedures appropriate for the determination of principle concepts, understanding, and generalizations for use in developing school curricula have been devised by a variety of investigators.

Martin (1944) described 30 studies that had been attempts to develop lists of principles, concepts, understandings, or generalizations. Similarly, Miles (1949) listed an additional 14, thereby bringing the total to 44 for this type of study. Others have continued to build and refine the techniques involved, notably the investigation of Irish (1953), Glidden (1953), Caldwell (1955), and Trainor (1964).

Robertson (1935) conducted a study to determine what principles of science were suitable as instructional goals for the elementary grades. The first step was a search of the literature which resulted in the selection of 243 science principles, each of which was then subjected to the judgments of a second jury to determine whether or not it met previously adopted scientific criteria. The step following the formulation of the list of important science principles involved selecting those suitable for the elementary school. Each judgment was the result of a "jury" action and finally resulted in a list of 113 principles recommended for the elementary school.

Because a wide range of opinions was noted among the elementary science experts as well as among the raters with respect to the statement of principles, it may be reasonable to explore any base for bias among a group of academic jurors.

Martin (1944) attempted to determine what principles in the biological sciences were important for general education. He divided

the problem into two parts: the compilation and refinement of a list of biological principles and an ordering of the principles according to their importance for general education. Procedures included:

1. An analysis of junior college science texts, high school biology text material, a survey series of the biological sciences for the general reader, and five lists of science principles reported in research studies.
2. Submission of the prepared list to three specialists in science education for the evaluation of each statement as follows:
    a. Whether or not the statement is a generalization in the biological sciences.
    b. Whether or not the statement is a principle according to the investigator's definition.

Statements meeting both criteria were judged to be major, while those meeting only the first were considered minor, principles.

3. The list was submitted to three subject matter specialists who refined the statements and judged the scientific credibility of each.
4. A "master list" of 300 major, and 236 minor, principles was submitted to a panel consisting of three teachers and two laymen who evaluated each principle on a 5-point scale.
5. Results were tabulated and an item mean score was determined for each principle.
6. The 300 major and related 236 minor principles were ranked in descending order of importance for use in general education.

Martin demonstrated a procedure of investigation that was useful in determining what principles could be used in general education.

Irish (1953) conducted an investigation designed to "...select and organize, from periodical literature, printed materials concerned with soil conservation suitable for integration with courses of high school science for general education." A second phase of the study was to "...assign the various aspects of the selected printed materials to scientific principles and/or attitudes as described by Martin (1944), Wise (1941), and Curtis (1924)." Procedures included:

1. Construction of an outline consisting of the topical areas related to soil conservation. Three professors in the School of Forestry and Conservation, at the University of Michigan, served as guides in locating and identifying appropriate printed materials related to soil conservation in representative magazines and newspapers.
2. Analysis of 1 month's issues of four newspapers and a year's issues of three magazines.
3. Selection of 49 "aspects" (e.g., "contour cultivation," or "to determine water content in watersheds") of soil conservation and organization of the "aspects" into five major categories.
4. Assignment of values to each of the 49 "aspects" by five specialists in the teaching of science.
5. Analysis of results and the assignment of each of the 33 "aspects" receiving positive values to appropriate related lists of principles:
    a. 270 principles of the physical sciences determined by Wise (1941);
    b. 300 major principles of the biological sciences assembled by Martin (1944);
    c. one of the 5 major science attitudes formulated by Curtis (1924).

A useful technique used by Irish was the rating scale that was designed to determine the relative values assigned to each "aspect" of soil conservation. The scale utilized was a modification of a rating scale developed by Blanchet (1946) who used algebraic sums of the evaluations of the various items being analyzed as an indication of the true value of the item.

Glidden (1953) attempted to determine: (1) "What principles within the area of soil and water conservation should be developed at the secondary school level?", (2) "How well are these principles being learned from active participation in American life, as from schools, club work, reading, listening to radio, etc. ?", and (3) "Do modifications of the secondary school curriculum in the area of soil and water conservation seem desirable?" Twenty-nine publications (bulletins, pamphlets, and monographs) were obtained from soil and water conservationists and a list of 100 principles was developed and sent to experts in soil and water conservation to check their validity. A refined list of principles was then sent to two groups of specialists in education, 43 science educators, and 34 specialists in secondary education and curriculum "...for evaluation of adaptability and importance for the secondary school curriculum." The principles were rated on the basis of their appropriateness for use as an objective which could guide the selection of learning experiences for all pupils at some point in the junior or senior high school curriculum. When a 6-point scale was used to evaluate 100 principles, 34 were eliminated. A Chi square test of ratings of the two groups of evaluators revealed no significant differences. A 66-item objective test based on the 66 principles retained was developed and administered to

second semester seniors in 33 schools in different parts of the United States. A mean score of 44.18 for 1,021 cases was secured and on that basis it was concluded that high school seniors are not adequately informed in the area of soil and water conservation. In addition it was suggested that secondary school curricula should be modified to include more effective teaching in this area. It is suggested that Glidden's 1953 study represents the first scientifically developed research approach to determine the basic principles of any area of conservation. A basis is also suggested for looking at differences of opinion about the importance of certain principles between groups of experts and among representatives of various regions of the country.

Caldwell (1955) conducted a study to determine what earth science principles to include in science programs in the general education curriculum of the secondary school and to determine the relative importance of each of those principles. The three phases involved in the study were: (1) the compilation of source materials in earth science from 13 textbooks, 8 reference books, 4 bulletins, and 2 research investigations; (2) an analysis of the source materials for statements of tentative earth science principles; and (3) a determination of the relative importance of 344 earth science principles which were selected to be included in the science program of the secondary school. A validity check was accomplished by comparing the investigator's selected list of 344 principles with a list derived independently by an assistant in biology who used the same technique on 50 pages of source material. After the list was submitted to two science teachers to eliminate duplication, 332 of the original 344 principles remained. The principles were then evaluated on a 3-point scale (+3 highly desirable, +2 desirable, -2 undesirable) by five educators to determine their relative importance for inclusion in the science program of the secondary schools. The ratings given were tabulated and the sum of the ratings for each recorded. With 292 principles remaining, the items were arranged in a descending order of importance. The form of the rating scale proved to be useful in describing the relative importance of each item and also in eliminating objectionable statements of principles from the list.

Trainor (1964) conducted an investigation designed: "To determine science concepts that should be taught in the junior high school science program;" and "To determine the grade level at which these concepts should be developed." Procedures included:

1. Developing a list of 357 concepts relating to junior high school science based on relevant literature.
2. Employing a survey technique involving:
   a. the use of a questionnaire designed to accommodate additions to the list; and
   b. an interview to obtain comments from each respondent on ways to improve the list.
3. Conducting a pilot study to refine the questionnaire involving 18 selected educators.
4. Selecting a stratified random sample of 52 public schools in Rhode Island.
5. Delivering questionnaires to the principal of each school in the sample for distribution to selected elementary, junior high, and senior high school teachers.
6. Analyzing the data and establishing a minimum cut-off point of 50% agreement to be used in developing a final list of science concepts.

A pilot study with 16 of the 18 respondents completing questionnaires resulted in the development of a revised list of 285 concepts from the original list. Of the 164 questionnaires delivered to the randomly selected panel, 130 (79.3%) were completed and returned. These data indicated that 62 of the 285 concepts were to be developed in the junior high school. Further analysis indicated that at least 50% of the secondary teachers agreed that 190 concepts should be taught in junior high school. Only five concepts were indicated by Sixth Grade teachers as being appropriate for junior high school use but 75 concepts were indicated for use in elementary school and three in senior high school. It was concluded that the junior high school science curriculum needs to be re-examined and modified and that there is inadequate preparation of elementary teachers in science.

CONSERVATION EDUCATION CURRICULUM DEVELOPMENT

Early investigations in conservation education dealt with inventorying the extent of conservation teaching throughout the United States or in given geographic areas. Both attitudes and information possessed by students were of concern to Sherman (1950). The kinds of information being taught, the sources of conservation understandings, and the extent of conservation teaching were topics studied by Donnelly (1957), Hone (1959), Graff (1962), and Kenyon (1965). Sherman (1950) conducted a study designed to ". . . compare the conservation attitudes possessed by

elementary school teachers in training with those of specialists in conservation;" and to "...investigate the extent to which conservation information and other selected factors may be related to the possession of these attitudes." The procedures included use of an attitude inventory, an information test, and a questionnaire, all of which were administered to 1,626 respondents from selected State Teachers Colleges in Missouri and Kansas. Results obtained indicated that: (1) the attitude inventory was useful; (2) common factors were operating to influence conservation information and attitude attainment; (3) additional science training increased the amount of conservation information and the number of attitudes held by the respondents; (4) conservation courses were held to be responsible for a rise in conservation information acquisition; and (5) inability to make clear-cut decisions on conservation issues was related to a lack of information and/or sufficient experience. Sherman concluded that conservation should be an integral part of the curriculum, that a direct teaching methodology is better than incidental or indirect methods, and that specific materials and technical help on conservation is needed.

A determination of the conservation ideas of two groups of urban Sixth Grade students was made by Donnelly (1957); one group of 182 students responded to 20 multiple-choice items and the other group of 100 students responded to "free-response" items involving the same questions. The five categories of questions developed after reading and conferring with science and social studies teachers and members of the New York Conservation Society were: (1) state of balance; (2) interrelationships; (3) intelligent utilization of natural resources; (4) beauty; and (5) maintaining a safe and healthful environment. Final judgment of the categories of questions was made by two judges, a science teacher and an elementary school principal with a background in science. An oral interview of one-ninth of the total study group was attempted to obtain information about sources of the students' ideas. Analysis of the data revealed that experience and observation, as well as the use of science books, were the greatest sources of information about conservation that were utilized by the students sampled.

Graff (1962) attempted "...to provide an index to some of the conservation understandings held by intermediate grade students in Ohio." When oral and written response methods were used to obtain data it was found that the number of conservation understandings reported during oral interviews by the students was not significantly greater than other numbers reported when the students were asked to write the understandings. It was also found that intermediate grade students showed little awareness of mineral resources or the socio-economic aspects of conservation. The terms "saving" and "preserving" were commonly used in defining conservation, and the students seemed to know the "most" about soil, water, plant, and animal resources, particularly those students staying in the same school through both the primary and intermediate grades. It was concluded that in the intermediate grades, science and social studies students should be encouraged to "...think of conservation as an essential element involving all social and scientific adjustment."

A 9-year comparative study of the status of conservation education in the public elementary schools of New York State from 1955 to 1964 was made by Kenyon (1965) "...to discover and interpret trends in the elementary teachers philosophy, methodology, preservice and inservice education, and use of materials in conservation education" and "...to determine from elementary principals the essential needs for improving conservation education and the projects, activities, or organizations that currently contribute to conservation consciousness in the schools." Results obtained were compared with a similar 1955 study to determine trends and promising practices. It was concluded that the public schools of New York State have failed to change the status of conservation education over the 9-year period. Few teaching and learning situations were consistently indicated as being used in the resource areas of soil, water, forests, wildlife, and minerals. A need for more conservation teaching on the elementary and secondary levels was evinced, as well as a need for inservice and preservice education of teachers. Handbooks of various types were also indicated as being desirable. It can be inferred from this study that teachers don't know what conservation concepts or principles to teach.

IMPLICATIONS FOR THE PRESENT REPORT

The techniques involved in developing and organizing concepts and principles as goals of instruction have been demonstrated in the literature. Robertson (1935) demonstrated a technique and developed a rating system for determining science principles considered to be suitable as goals of instructions for the elementary grades. Martin (1944) refined and expanded the techniques for developing and

organizing concepts for instructional purposes including the use of panels of specialists and the use of item mean scores to establish ranked concepts in a descending order of importance. Irish (1953) further modified the rating system after Blanchet (1946), and Glidden (1953) suggested exploration of differences of opinion among experts and representatives of regions of the country. Caldwell (1955) further refined the rating techniques and developed a basis for the elimination of objectionable items. The design of a questionnaire that could allow additions and comments as well as use of the interview technique to obtain further clarification and information was contributed by Trainor (1964). All of the preceding techniques have been employed with some modifications to secure the information reported here.

Content and methodologies appropriate for conservation education have undergone some changes but must undergo still more. Sherman (1950) indicated that conservation teaching should be part of the general public school curriculum and that a direct approach, as well as specific information and material, is needed. Donnelly (1957) demonstrated that conservation information and attitudes are centered on the physical environment and that the experiences of the student and the science textbooks he uses are the predominant sources of the student's conservation information. Graff (1962) suggested that intermediate grade students exhibited little awareness of mineral resources or the socio-cultural aspects of conservation and that a continued exposure, at least from the primary through the intermediate grades, is needed to develop a familiarity with conservation understandings. Kenyon (1965) posed the opinion that the public schools have changed little in 9 years regarding their traditional focus on agrarian conservation.

Based on the preceding studies it can be inferred that there is urgent need to develop an organization of environmental management concepts that will be of use in broadening the base of conservation understanding to serve as an up-to-date source for developers of conservation materials and curricula.

Attempts to develop conservation concepts have been limited to an agrarian focus, a regional orientation, or the concepts have been judged by a restricted and traditionally oriented panel of conservation experts. Visher (1960) developed an expanded list of concepts for conservation education but they remained in the traditional orientation. Yambert (1961) attempted to devise a new framework for considering conservation generalizations but it was not generally accepted. Hanselman (1963) indicated the need and possible support for interdepartmental approaches for conservation education but used "traditional conservationists" as jurors in validating his concept list. White (1967) showed the relationship of selected conservation understandings to community resources but developed understandings with the agrarian orientation and with only local applicability. He did note possible biases toward the rating of understandings among professional conservationists and college teachers, as well as the need for concepts more acceptable to conservationists. On the basis of the preceding, a different organization and orientation of conservation concepts that are appropriate for an understanding of the total environment and man's role in it are to be sought for purposes of developing effective approaches to environmental management education.

IV
PROCEDURE

The survey techniques employed here to obtain and validate concepts appropriate for environmental management education involved written instruments and personal interviews. The population surveyed consisted of scholars in disciplines related to environmental management who were associated with selected universities in the United States. The project was initiated by utilizing scholars on The University of Wisconsin campus. The list of concepts suggested by those scholars was then submitted to a National Panel of Scholars that represented the same professional areas as those in the Wisconsin Phase.

The concepts included in the final taxonomy were those agreed upon by 90% of National Panel members responding.

SELECTION OF PANELS

The Wisconsin Panel, initially 88 members, comprised 67 scholars representing 40 disciplinary areas, including the sciences, humanities, and social studies, meeting the following criteria:

a. interested, or actively engaged, in conservation and/or environmental management education;
b. located at The University of Wisconsin;
c. likely to participate in the study.

The final National Panel consisted of 350 scholars representing 40 disciplinary areas. The initial panel of 699 environmental management educators and practitioners corresponding by professional area to those in the Wisconsin Phase of the study was selected from those who met the following criteria:

a. generally committed to the area of this study by professional activity and interest; and
b. willing to devote 2 hours of time to the completion of a survey instrument.

To assure breadth of coverage in the United States, two universities located in each of 12 of Transeau's Major Vegetation Zones in the U.S. were selected (Tundra, Boreal Forest, Pacific Forest, Rocky Mountain Forest, Hemlock-Hardwood Forest, Grassland, Chaparral, Northern Desert, Deciduous Forest, Southeast Evergreen Forest, Sonoran and Chihuahuan Desert, Tropical Rain Forest). Twenty-seven universities were selected from those of the Association of University Summer Sessions and/or the National Association of College and University Summer Sessions which met the criteria of being large universities having extensive graduate programs. The Director of Summer Sessions from each of the selected universities was contacted and requested to provide the names of 40 individuals corresponding to the 40 academic areas represented on the Wisconsin Panel (Table 1). The Summer Session Director was believed to be the one likely to know of the professional interests and activities of many of the faculty members within the institution he serves. The total sample obtained included about 700 individuals.

CONCEPT LISTS

Initial List

Major concepts relating to the general areas traditionally considered to be conservation or: wildlife management, plant ecology, water management, soils, political science, economics, and also the areas of sociology and cultural anthropology were collected as a result of reviewing the relevant literature in each area (Table 2). The 89 concepts collected were listed and presented to The University of Wisconsin Panel.

Table 1

Professional Academic Areas of The Wisconsin Panel of Scholars

1. Agriculture (General)
2. Agriculture Economics
3. Art (Fine Arts)
4. Botany (Plant Ecology)
5. Chemistry
6. Civil Engineering
7. Commerce (Business)
8. Community Leadership
9. Computer Sciences
10. Economics
11. Education
12. Environmental Design
13. Food Science
14. Genetics
15. Geography
16. Geology
17. Guidance and Counseling
18. Hydrology (Water Resources)
19. Journalism
20. Landscape Architecture
21. Mass Communications
22. Medical Education
23. Meteorology
24. Music
25. Natural Resources Conservation
26. Oncology (Biochemistry)
27. Parks and Recreation Management
28. Pharmacology
29. Physics
30. Political Science
31. Public Health
32. Recreation Education
33. Rural Sociology
34. Social Work
35. Sociology
36. Soils
37. Theater Production
38. Urban and Regional Planning
39. Veterinary Science
40. Wildlife Ecology

Table 2

Sources Analyzed

College Conservation Texts

Allen, W. W. An introduction to American forestry. New York: McGraw-Hill, 1950.

Allen, W. W. Conserving natural resources. New York: McGraw-Hill, 1955.

Benton, A. H. & Werner, W. E., Jr. Principles of field biology and ecology. New York: McGraw-Hill, 1958.

Ciriacy-Wantrup, S. V. Resource conservation economics and policies. University of California Division of Agricultural Sciences Agricultural Experiment Station. Berkeley, California, 1963.

Dasmann, R. F. Environmental conservation. New York: John Wiley and Sons, Inc., 1968.

Odum, E. P. Fundamentals of ecology. W. B. Saunders Co., Philadelphia, 1959.

Smith, G. H. Conservation of natural resources. New York: John Wiley and Sons, Inc., 1959.

Smith, R. L. Ecology and field biology. New York: Harper and Row, 1966.

Stallings, J. H. Soil conservation. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1957.

Reference Books

Darling, F. F. & Milton, J. P. Future environments of North America. Garden City, New Jersey: The Natural History Press, 1966.

Table 2, cont.

Goodenough, W. H. Cooperation in change. New York: John Wiley and Sons, Inc., 1966.

Herfindahl, O. C. & Kneese, A. V. Quality of the environment. Resources for the Future, Inc., Distributed by the Johns Hopkins Press, Baltimore, Maryland, 1965.

Jarrett, H., Editor. Perspectives on conservation. Resources for the Future, Inc., Washington, D.C., Distributed by the Johns Hopkins Press, Baltimore, Maryland, 1958.

Landsberg, H. H. Natural resources for U.S. growth. Resources for the Future, Inc., Distributed by the Johns Hopkins Press, Baltimore, Maryland, 1964.

Spicer, E. H. Human problems in technological change. New York: John Wiley and Sons, Inc., 1952.

The White House. Restoring the quality of our environment. Report of the Environmental Pollution Panel of the President's Science Advisory Committee, 1965.

Young, K. Sociology: a study of society and culture. New York: American Book Company, 1939.

Conservation Curriculum Guides

American Association of School Administrators. Conservation Education in American schools. National Education Association, Washington, D.C., Twenty-ninth Yearbook, 1951.

Bathurst, E. G. & Hill, W. Conservation experiences for children. U.S. Department of Health, Education, and Welfare, Bulletin 1957, No. 16, 1957.

Conservation Foundation. Concepts of conservation: a guide to discussion of some fundamental problems. Washington, D.C., 1963.

Dambach, C. A. & Finlay, R. R. A guide to teaching conservation in Ohio elementary schools. Ohio Forestry Association, Inc., Columbus, Ohio, 1961.

Herrington, E. H. & Robbins, L. Curriculum guide in conservation education. Colorado State Department of Education and Colorado State Department of Game, Fish and Parks, Denver, Colorado, 1964.

Munzer, M. E. & Brandwein, P. F. Teaching science through conservation. New York: McGraw-Hill, 1960.

New York City Board of Education. Operation New York: using the natural environment of the city as a curriculum resource. Bureau of Curriculum Research, Board of Education of the City of New York, New York.

The Ohio State University. Objectives and content of conservation education for American youth. College of Education, The Ohio State University, Columbus, Ohio, 1950.

Weaver, R. L. Handbook for teaching of conservation and resource-use. National Association of Biology Teachers, Ann Arbor, Michigan, 1955.

Weihaupt, J. G. Study guide of oceanography. U.S. Armed Forces Institute, Madison, Wisconsin, 1966.

Doctoral Dissertations

Hanselman, David L. Interdepartmental teaching of conservation at the Ohio State University. Natural Resources Institute, The Ohio State University, Columbus, Ohio., 1963.

Visher, Halene Hatcher. A determination of conservation principles and concepts deservable for use in the secondary schools. University of Indiana, Evansville, Indiana, 1960.

White, Roy C. A study associating selected conservation understandings with available community resources for grades four through twelve. University of Montana, Missoula, Montana, 1967.

Yambert, Paul Abt. A principle and concept perspective of conservation. University of Michigan, Ann Arbor, Michigan, 1961.

Establishing Concept Credibility

The initial list of 89 concepts was sent to the Wisconsin panel along with a letter indicating the nature of the participation desired of them; each panel member was to accept or rewrite the concepts listed and to make additions wherever necessary. Each panel member was also contacted so that a time for a personal interview could be scheduled. During this interview the completed survey instrument was picked up and each scholar was requested to respond to the question: "What should a student know about environmental management?" A standard form of questioning was used and all relevant comments made by the scholar were recorded by the interviewer.

Revised Concept List No. 2

A revised list of 157 concepts based on the results of the survey instrument and interviews was formulated into an instrument utilizing a modified Blanchet scale technique. This scale provided the respondent with an opportunity to make one of four acceptable choices indicating descending order of importance or one unacceptable choice [Essential (+5), Highly Desirable (+4), Desirable (+3), Satisfactory (+2), Unacceptable (-5)] relative to each concept. In addition each panel member was invited to judge individual item credibility.

Revised Concept List No. 3

A third list of 128 concepts, based upon the reactions to List No. 2, was formulated again utilizing the Blanchet scale. The revised list was sent to the 699-member National panel along with a cover letter explaining the nature of the participation desired for evaluation in terms of credibility and degree of acceptability.

TREATMENT OF DATA

Wisconsin Phase

The written comments and additions made by the Wisconsin Panel on Concept List No. 1 were recorded and used in revising the initial list.

Data consisting of the reactions of the Wisconsin Panel to List No. 2 (Blanchet scale) were tabulated using the Reciprocal Averages Program (RAVE) (Baker, 1968) and the frequencies of response for each of the five categories were determined. A 75% level of total acceptability was established as a criterion to exempt a concept from further revision or exclusion.

National Phase

The List No. 3 data were tabulated using RAVE and the frequencies for each of five categories of response were determined. A 90% level of acceptability was established as requisite for concepts to be included in the final list. Therefore, any concept receiving 10% or more unacceptable responses was eliminated from the list and the reasons for its exclusion were analyzed.

Forming the Topical List

Each concept that received a 90% or greater level of acceptable responses was ranked according to order of importance, based on a weighted item mean score derived by using the formula:

$$\frac{5n_1 + 4n_2 + 3n_3 + 2n_4 - 5n_5}{\Sigma n_i} = \text{Weighted Item Mean Score}$$

Using this formula the maximum attainable score was 5.0.

Each concept was then classified according to topic and arranged in the order of assigned importance (weighted item mean scores). It was assumed that the panels of scholars represented the interdisciplinary area of environmental management education and that their judgments of the relative importance of each concept was credible.

Two possible sources of bias that could cast doubt on the credibility of the final concept list were suggested: discipline of the respondent and ecological region of the respondent.

The possible relevance of the academic discipline of the panel member as a basis for concept rejection was tested by reviewing the academic affiliation of those individuals who rejected a given concept. A determination of academic discipline-related biases was made by analyzing the frequencies of "unacceptable" markings and the written comments made about each item excluded.

The possible relevance of the ecological region of the panel member as a basis for concept rejection was tested by reviewing the regional association of those individuals who rejected a given concept. A determination of regional biases was made by analyzing the frequencies of "unacceptable" markings and the written comments made about each item excluded.

V
RESULTS

INTRODUCTION

The results are presented in three parts: (1) The National Panel; (2) Development of the Taxonomic List; and (3) Subproblem Analysis.

THE NATIONAL PANEL

The National Panel initially selected consisted of 699 scholars representing 40 disciplines in 24 universities from 12 ecological zones in the United States; however, usable responses were received from only 350 (50.7%) representing the 40 disciplines in the 24 universities located in the 12 ecological zones. Note from Table 3 that

Table 3

Response by University to the Mailed Survey Instrument

University Number	Total Mailed	Total Respondents	Completed Instruments
1	31	28	25
2	29	23	13
3	38	26	23
4	31	19	11
5	30	15	12
6	27	15	6
7	36	11	4
8	30	26	21
9	33	20	14
10	34	24	19
11	36	25	17
12	28	23	21
13	12	8	7
14	30	28	26
15	23	17	11
16	26	13	10
17	27	13	8
18	19	11	7
19	35	19	13
20	32	19	16
21	38	24	20
22	20	10	6
23	35	27	22
24	29	19	18
Totals	699 (100%)	463 (66.23%)	350 (50.07%)

Table 4

Number of Respondents by Academic Discipline

Academic Disciplines	Respondents
1. Agriculture (General)	5
2. Agriculture Economics	5
3. Art (Fine Arts)	11
4. Botany (Plant Ecology)	14
5. Chemistry	14
6. Civil Engineering (Sanitation Engineering)	13
7. Commerce (Business)	6
8. Community Leadership (Extension Education)	8
9. Computer Sciences	6
10. Economics	10
11. Education	18
12. Environmental Design	4
13. Food Science	13
14. Genetics	7
15. Geography	13
16. Geology (Mining Engineering)	11
17. Guidance and Counseling	7
18. Hydrology (Water Resources)	5
19. Journalism	6
20. Landscape Architecture	9
21. Mass Communications	7
22. Medical Education	7
23. Meteorology	5
24. Music	7
25. Natural Resources Conservation	10
26. Oncology (Biochemistry)	7
27. Parks and Recreation Management	4
28. Pharmacology	4
29. Physics	12
30. Political Science	10
31. Public Health	7
32. Recreation Education	13
33. Rural Sociology	3
34. Social Work	7
35. Sociology	12
36. Soils (Agronomy, Soil,and Water Conservation)	9
37. Theater Production	10
38. Urban and Regional Planning	8
39. Veterinary Science	7
40. Wildlife Ecology (Wildlife Management, Zoology)	16
Total	350

there were 4 or more responses from each of the 24 universities; however, no institution had a 100% response record. The discrepancy between the total number responding (463 or 66.23%) and the number of panel members completing useable questionnaires (350 or 50.07%) is explained by the fact that some respondents merely returned their questionnaires indicating that they had "no time," or this was "beyond my professional competence and/or interest."

When the respondents were classfied according to discipline (Table 4), it was found that there were at least three scholars representing each discipline. Although the number of respondents varies from one discipline to another, it is assumed that the unequal numbers of respondents do not affect the results.

The tabulation by geographic distribution of the panel members (Table 5) also reveals that there is multiple representation from each of the 12 ecological zones. Although the

number of respondents located within each of the 12 ecological zones varies, it is assumed that this does not affect the results.

Table 5

Number of Respondents by Ecological Zone*

Ecological Zone	Respondents
1. Tundra	3
2. Boreal Forest	21
3. Pacific Forest	30
4. Rocky Mountain Forest	33
5. Hemlock-Hardwood Forest	52
6. Grassland	75
7. Chaparral	11
8. Northern Desert	33
9. Deciduous Forest	24
10. Southeast Evergreen Forest	32
11. Sonoran and Chihuahuan Desert	29
12. Tropical Rain Forest	7
Total	350

*From E. N. Transeau (1948)

THE TAXONOMIC LIST

The 111 concepts that met the criterion "acceptable by 90% of the panel members responding," are classified by topic in Table 6. Note that although the concepts listed all met the criterion, all were not rated at the same levels of essentiality; the weighted item mean scores vary from 4.85 to 2.54. Concept No. 1 has implications for the majority of topics that follow and therefore has been placed singly at the top of the list. The topical classifications of the concepts are: Environmental Management (16 concepts); Management Techniques (8 concepts); Economics (18 concepts); Environmental Problems (3 concepts); Environmental Ecology (8 concepts); Adaptation and Evolution (9 concepts); Natural Resources (18 concepts); Sociocultural Environment (10 concepts); Culture (4 concepts); Politics (5 concepts); The Family (1 concept); The Individual (6 concepts); and Psychological Aspects (4 concepts).

POSSIBLE BIAS JUDGMENTS

Examination of the "unacceptable" concepts and the frequency of rejection of each concept given in Table 7 reveals little to help understand the cause of rejection. Note that only one of the concepts (No. 65) was rejected by as many as 27% of the judges; the other 16 were rejected by 18% or fewer of the judges.

A speculated cause of rejection of a given concept was that scholars in a given discipline may, because of orientation, not assess a high value to a given concept. When the rejected concepts are tabulated according to the discipline of the respondents as in Tables 8 - 24, there is little evidence to support this speculation. Examination of Concepts No. 15, 18, 24, 43, 100, 111, and 112 provides no clear evidence of any pattern. While analyses of the tabulation of the remaining 10 concepts reveal very little pattern, a slight indication might be suggested. Four concepts were rejected by 45.5—60% of the respondents from a given discipline as follows: Concept 21—8 of 16 Wildlife Ecology respondents (50%); Concept 25—3 of 6 Commerce respondents (50%); Concept 77—6 of 10 Political Science respondents (60%); and Concept 94—5 of 11 Geology respondents (45.5%). Three concepts were rejected by 40—60% of two groups of respondents as follows: Concept 45—4 of 10, Political Science (40%) and 3 of 7, Guidance and Counseling (42.9%); Concept 46—6 of 10, Political Science (60%) and 3 of 7, Social Work (42.9%); and Concept 65—5 of 10, Natural Resource Conservation (50%) and 4 of 8, Urban and Regional Planning (50%). One concept was rejected by about 40% of the respondents representing three disciplines as follows: Concept 55—3 of 7, Oncology (42.9%); 4 of 10, Political Science (40%); and 5 of 12, Sociology (41.7%). Two concepts were rejected by 40—50% of the respondents from 5 disciplines as follows: Concept 53—2 of 5, Agriculture (40%); 6 of 14, Botany (42.9%); 2 of 5, Hydrology (40%); 4 of 10, Natural Resources Conservation (40%); 3 of 7, Social Work (42.4%); and Concept 54—4 of 7, Medical Education (57.1%); 5 of 10, Natural Resources Conservation (50%); 3 of 7, Music (42.9%); 3 of 7, Oncology (42.9%); 4 of 10, Political Science (40%). However, since the preceding is based on fewer than 20% of the respondents on the National Panel, it would seem that any indication of bias of respondents associated with his discipline would be tenuous, at best.

[Tables 6 through 24 follow.]

TABLE 6

Taxonomic List of Concepts for Environmental Management Education
Organized According to Topic and Weighted Item Mean Score

	Concept No.*	Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
1.	(1)	Living things are interdependent with one another and their environment.	315	17	14	2	0	4.85
		Environmental Management						
2.	(4)	Man has been a factor affecting plant and animal succession and environmental processes.	246	66	28	8	0	4.58
3.	(78)	The management of natural resources to meet the needs of successive generations demands long-range planning.	236	65	24	11	5	4.42
4.	(56)	Environmental management involves the application of knowledge from many different disciplines.	186	82	48	23	0	4.27
5.	(62)	Modern man affects the structure of his environment.	175	84	53	20	6	4.08
6.	(127)	Esthetic resources and recreational facilities of economic and noneconomic value are becoming increasingly important in leisure-time activities.	156	100	52	25	3	4.08
7.	(87)	Man has ability to manipulate and change the environment.	161	87	54	28	5	4.01
8.	(86)	A knowledge of the social, physical, and biological sciences and humanities are important for environmental understanding.	164	96	47	21	9	3.98

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6

Taxonomic List of Concepts for Environmental Management Education Organized According to Topic and Weighted Item Mean Score

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
9.	(60)	Social and technological changes alter the interrelationships, importance, and uses for natural resources.	124	114	76	22	3	3.93
10.	(102)	There are certain risks taken, and limitations experienced, when manipulating the natural environment.	133	98	67	37	2	3.92
11.	(63)	Resource depletion can be slowed by the development and adoption of alternatives.	134	105	65	24	8	3.84
12.	(97)	Environmental management has effects on individuals and social institutions.	114	88	84	45	3	3.74
13.	(68)	Man's need for food, fiber, and minerals increases as populations expand and levels of consumption rise.	139	68	83	39	10	3.67
14.	(73)	Conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.	122	93	76	30	11	3.65
15.	(93)	A cultural and time lag exists between the development of knowledge in science and technology and application of that knowledge to resource and environmental problems.	97	90	90	47	11	3.44
16.	(90)	Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.	60	84	91	56	34	2.62
17.	(91)	The management of natural resources is culture bound.	50	66	98	68	31	2.52

*Concept numbers correspond to enumeration used on the questionnaire in Appendix

TABLE 6 (continued)

Concept No.*	Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
	Management Techniques						
18. (69)	Increased population mobility is changing the nature of the demands upon some resources.	101	96	90	39	7	3.61
19. (96)	Options available to future generations must not be foreclosed.	154	86	53	16	26	3.51
20. (113)	A variety of institutional structures is involved in planning and managing the environment.	80	81	102	64	2	3.49
21. (47)	Hunting regulations are useful in maintaining and restoring populations as well as in distributing the game harvest.	92	84	87	61	8	3.43
22. (71)	Multiple use is a practice in which a given land area functions in two or more compatible ways.	91	104	78	46	13	3.41
23. (42)	Management of habitat is considered to be an effective technique of wildlife management when the desire is to increase numbers of particular populations.	79	100	94	41	13	3.35
24. (122)	Architecture can be one of the positively persuasive influences in developing a congenial environment.	74	95	85	71	10	3.27
25. (72)	Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.	72	89	101	54	14	3.20
	Economics						
26. (84)	Ready transportation, growing interest, money surpluses, and increased leisure time combine to create heavy pressures on existing recreation facilities and demands for new ones.	159	83	65	26	6	3.96

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6

Taxonomic List of Concepts for Environmental Management Education
Organized According to Topic and Weighted Item Mean Score

	Concept No.*	Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
27.	(128)	Outdoor recreation is an increasingly important part of our culture and our economy.	138	93	71	32	3	3.93
28.	(28)	The economy of a region depends on the utilization of its natural, human, and cultural resources and technologies over time.	147	96	65	22	12	3.79
29.	(82)	Economic efficiency does not always result in conservation of a natural resource.	157	88	47	36	12	3.79
30.	(61)	The distribution or location of resources in relation to population, technological, and economic factors are critical to problems of resource conservation and use.	125	87	88	33	7	3.73
31.	(58)	The political and economic strength of a country is, in part, dependent upon its access to domestic and foreign resources and international relationships.	116	96	75	40	8	3.67
32.	(66)	Conservation policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.	127	92	78	28	14	3.61
33.	(83)	Conventional benefit-cost analyses do not always result in sound conservation decisions.	123	94	62	39	15	3.54
34.	(85)	A sound natural resource policy is dependent upon a flexible political system, pragmatically appraising and reappraising policies and programs in terms of their effect upon the public interest and in light of scientific knowledge about the natural resources.	126	89	65	37	16	3.53

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6 (continued)

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
35.	(75)	Consumption practices are constantly being expanded by our ability to produce and create wants and markets, which affect the rate of resource use.	90	103	80	47	11	3.45
36.	(81)	Individuals tend to select short-term economic gains, often at the expense of greater long-term environmental benefits.	131	88	52	42	27	3.27
37.	(76)	Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.	99	63	85	57	17	3.21
38.	(80)	Goods and services are produced by the interaction of labor, capital, natural resources, and technology.	82	67	85	90	10	3.18
39.	(105)	Long-range planning for the use and allocation of natural and human resources is continually evolving.	95	87	82	46	22	3.17
40.	(74)	Choices between needs (essentials) and wants or desires (nonessentials) are often in conflict.	96	75	93	49	21	3.15
41.	(79)	Raw materials and energy supplies are generally obtained from those resources and places where they are available at least cost, usually in short economic terms.	69	80	94	73	20	2.96
42.	(64)	Supply and demand, in relation to values held by society, determine what is a resource and its economic values.	78	89	102	36	32	2.86
43.	(67)	The more efficient use of some resources is the result of technical and marketing improvements.	54	67	111	69	23	2.76

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6

Taxonomic List of Concepts for Environmental Management Education
Organized According to Topic and Weighted Item Mean Score

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
		Environmental Problems						
44.	(9)	Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radio-active wastes and heat, is important if the well-being of man and the environment is to be preserved.	275	51	17	2	3	4.65
45.	(8)	Pollutants and contaminants are produced by natural and man-made processes.	211	60	47	13	12	4.09
46.	(49)	Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promote increasing environmental contamination.	204	71	22	22	15	4.01
		Environmental Ecology						
47.	(2)	Natural resources are interdependent and the use or misuse of one will affect others.	245	64	21	7	10	4.35
48.	(20)	In any environment, one component like space, water, air, or food may become a limiting factor.	191	89	39	20	4	4.22
49.	(22)	Most resources are vulnerable to depletion in quantity, quality, or both.	204	74	36	23	7	4.17
50.	(5)	The interaction of environmental and biological factors determines the size and range of species and populations.	147	94	77	13	11	3.84
51.	(29)	Natural resources, water and minerals in particular, are unequally distributed with respect to land areas and political boundaries.	144	72	81	38	8	3.75

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6 (continued)

	Concept No.*	Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
52.	(26)	The renewable resource base can be extended by reproduction, growth, and management.	136	106	58	23	13	3.75
53.	(57)	Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.	106	99	72	47	9	3.58
54.	(3)	The natural environment is irreplaceable.	185	50	37	18	52	2.96
55.	(10)	An organism is the product of its heredity and environment.	188	67	60	26	3	4.14
56.	(12)	Man is influenced by many of the same hereditary and environmental factors that affect other organisms and their populations.	148	81	74	35	8	3.80
57.	(14)	The rate of change in an environment may exceed the rate of organism adaptation.	133	101	72	26	10	3.76
58.	(16)	Organisms and environments are in constant change.	142	74	75	37	16	3.56
59.	(11)	All living things, including man, are continually evolving.	143	77	68	40	19	3.49
60.	(13)	The form of life present depends upon the coincidence of the life needs and their availability in an environment.	107	79	83	43	21	3.25
61.	(17)	Biological systems are described as dynamic because the materials and energy involved are parts of continuous cycles; inorganic materials and energy become part of organic materials and are subsequently broken down into simpler substances and energy as a result of the operation of organic systems.	108	66	84	43	26	3.09

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6

Taxonomic List of Concepts for Environmental Management Education
Organized According to Topic and Weighted Item Mean Score

	Concept No.*	Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
62.	(40)	Animal populations are renewable resources.	90	84	91	45	24	3.08
63.	(19)	Succession is the gradual and continuous replacement of one kind of plant or animal complex by another and is characterized by gradual changes in species composition.	68	77	103	51	19	3.03
		Natural Resources						
64.	(37)	Water supplies, both in quantity and quality, are important to all levels of living.	226	57	40	13	3	4.39
65.	(7)	The earth and life on it are greatly affected by the atmosphere.	213	62	53	16	3	4.29
66.	(35)	Water is a reusable and transient resource, but the available quantity may be reduced or quality impaired.	190	88	34	22	6	4.17
67.	(70)	As populations increase competition for the use of water increases resulting in a need for establishing water use priorities.	163	100	48	22	3	4.13
68.	(36)	The amount of precipitation that becomes available for use by man varies with topography, land use, and applied management practices.	110	93	81	41	12	3.52
		(Minerals)						
69.	(31)	Mineral conservation involves the utilization of all known methods of using the minerals of the earth's crust that will cause them to serve more people for a longer time.	124	79	78	35	25	3.27
70.	(23)	The nonrenewable resource base is considered finite.	147	65	61	27	34	3.27

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6 (continued)

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
71.	(32)	Soil is classified as a renewable resource, but, because it may take a few years to thousands of years to be "renewed," it is more practically termed a depletable resource.	95	98	57	59	31	2.94
72.	(30)	Minerals are nonrenewable resources.	106	66	80	49	34	3.87
		(Soil)						
73.	(33)	Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.	179	101	46	15	2	4.25
74.	(27)	Geological processes like erosion and deposition modify the landscape.	122	62	98	56	5	3.61
75.	(34)	Soil productivity can be maintained by utilizing known agronomic, mechanical, and chemical processes.	111	96	83	33	14	3.51
		(Plants)						
76.	(39)	Green plants are the ultimate sources of food, clothing, shelter, and energy in most societies.	132	82	68	39	15	3.56
77.	(38)	Plants are renewable resources.	101	81	89	55	10	3.44
78.	(6)	Energy is supplied to an ecosystem by the activities of green plants.	127	69	66	38	21	3.36
		(Animals)						
79.	(48)	Wildlife refuges, undisturbed natural areas, and preserves may be of value in protecting endangered species and perpetuating the gene pool.	140	101	61	33	2	3.99
80.	(44)	Wildlife populations are important economically, esthetically, and biologically.	129	93	74	29	11	3.69

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6

Taxonomic List of Concepts for Environmental Management Education
Organized According to Topic and Weighted Item Mean Score

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
81.	(41)	Wildlife is considered to be a public resource.	101	100	71	40	22	3.26
		The Socio-Cultural Environment						
82.	(126)	Man has responsibility to develop an appreciation of and respect for the rights of others.	216	70	30	20	2	4.38
83.	(115)	Individual citizens should be stimulated to become well informed about resource issues, problems, management procedures, and ecological principles.	188	89	48	15	1	4.29
84.	(117)	Conservation responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.	184	85	43	17	6	4.16
85.	(98)	Man has moral responsibility for his environmental decisions.	178	80	43	24	12	3.94
86.	(88)	Knowledge of the social structures, institutions, and culture of a society must be brought to bear on environmental considerations.	119	96	82	24	8	3.75
87.	(59)	The relationships between man and the natural environment are mediated by his culture.	94	97	101	41	3	3.65
88.	(104)	Man is developing the technical and sociological knowledge needed to control population growth, modify environments, and alter resource use patterns.	124	100	65	33	15	3.58
89.	(109)	Social values and mores influence personal conservation behavior.	86	104	85	48	14	3.34

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6 (continued)

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
90.	(108)	Public opinion constitutes a control over the use of conservation practices.	84	101	76	48	23	3.11
91.	(114)	In a democracy, a basic theory is that increasing restrictions on resource allocation and use are imposed by the consent or insistence of the people.	69	80	89	68	22	2.92
		Culture						
92.	(50)	The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and lifeways that are transmitted to its progeny.	116	82	70	53	12	3.49
93.	(51)	Man has psychobiological and biosocial needs.	111	68	68	51	19	3.27
94.	(95)	Human resources include the physical and mental abilities with which man is endowed and the knowledge he has generated.	102	75	94	48	18	3.26
95.	(106)	Historically, cultures with high technological development have used more natural resources than those with lower levels of technological development.	79	78	91	57	23	2.98
		Politics						
96.	(116)	Individual citizens should be stimulated to become active in the political process.	148	92	58	34	8	3.85
97.	(118)	We have "legal" ownership of some resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the resource base.	159	81	49	34	14	3.75

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6

Taxonomic List of Concepts for Environmental Management Education
Organized According to Topic and Weighted Item Mean Score

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
98.	(92)	Policies, including natural resource policies, came about as the result of interacting social processes: science and technology, government operations, private interests, and public attitudes.	110	92	74	45	12	3.51
99.	(110)	Conservation policies are often the result of group action.	102	94	85	46	10	3.51
100.	(107)	As populations increase and/or as resource supplies decrease, the freedom of the individual to use the resources as he wishes decreases irrespective of the form of government.	133	76	63	37	20	3.44
		The Family						
101.	(103)	Family planning and the limiting of family size are important if over-population is to be avoided and a reasonable standard of living assured for successive generations.	200	70	29	21	19	3.88
102.	(123)	An individual must develop his ability to perceive if he is to increase his awareness and develop environmental perspective.	117	75	85	46	7	3.63
103.	(89)	Individuals perceive different self-roles depending upon their position in the social and environmental context.	66	73	92	80	16	2.99
104.	(101)	Man has the capability of improving society through sociology, psychology, and science.	91	91	67	57	29	2.95
105.	(52)	Man is a high animal form because of his ability to reason.	102	61	71	67	32	2.83
106.	(99)	Man is continually developing an ethical base for making value judgments.	63	82	86	58	33	2.65

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

TABLE 6 (continued)

Concept No.*		Concept	Essential	Highly Desirable	Desirable	Satisfactory	Unacceptable	Weighted Item Mean Score
107.	(119)	Man performs some tasks at a high physiological cost.	60	62	78	84	27	2.62
		Psychological Aspects						
108.	(125)	Opportunities to experience and enjoy nature are psychologically rewarding to many and are important to mental health.	120	100	62	36	13	3.60
109.	(124)	The need of man to turn inward for self renewal can be stimulated by his external esthetic experiences.	83	74	81	58	31	2.79
110.	(120)	Resources have a psychological impact on people.	74	59	97	67	26	2.78
111.	(121)	Emotional reactions can be elicited by exposure to physical objects and geometric forms.	55	55	88	96	27	2.54

*Concept numbers correspond to enumeration used on the questionnaire in Appendix.

Table 7

Concepts Rated as "Unacceptable" by 10 Percent or More of the National Panel

Concept	Frequency	Percent
15. A diverse biological community or culture perpetuates diversity within the gene pool.	35	10.0
18. At each successively higher level of an energy pyramid, the organic mass is reduced due to metabolic and energy transfer losses occurring at each exchange.	35	10.0
21. The carrying capacity of an ecosystem is the level at which a population can be sustained at an acceptable level of nutrition.	37	10.6
24. The rate of use of a nonrenewable natural resource is dependent upon supply and demand, availability of substances, and technology.	35	10.0
25. The rate of renewal of an exhaustible natural resource is usually extremely slow.	46	13.1
43. A rapid turnover of individuals making up a population of most species exists whether or not the species are exploited.	47	13.4
45. Nonmigratory small game wildlife populations cannot be stock-piled; when hunting mortality replaces natural mortality—the resource is utilized.	53	15.1
46. Migratory wildlife populations can be stock-piled for short periods of time.	55	15.7
53. Man's biological life requirements for growth and development are relatively constant.	59	16.9
54. Reduction of environmental stresses from excessive to optimum levels results in a feeling of well being.	63	18.0
55. A satisfactory level of physical, psychological, and social health for man depends upon an optimum level of environmental stress.	58	16.6
65. Mineral resources form the base of the cultural pyramid.	93	26.6
77. An increase in input (capital, labor, resources) will produce a proportionate increase in production or benefits up to a limit defined as the margin of diminishing returns.	47	13.4
94. Science does not cause or become independent of the natural environment.	48	13.7
100. There are sensory prerequisites to the appreciation of the cultural heritage.	47	13.4
111. Government is the interaction of custom, rule, and law.	47	13.4
112. Decisions in society are made through the interaction of countervailing power structures.	36	10.3

Table 8

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 15

Discipline	Frequency	Percent	Total Respondents
Agriculture Economics	1	20.0	5
Botany	3	14.3	14
Civil Engineering	3	23.0	13
Community Leadership	1	12.5	8
Education	3	16.7	18
Geography	3	23.1	13
Computer Science	1	16.7	6
Mass Communications	2	28.6	7
Meteorology	1	20.0	5
Music	1	14.3	7
Natural Resources Conservation	1	10.0	10
Oncology	1	14.3	7
Pharmacology	1	25.0	4
Public Health	2	28.6	7
Recreation Education	1	7.6	13
Social Work	2	28.6	7
Theater Production	1	10.0	10
Urban and Regional Planning	2	25.0	8
Veterinary Science	2	28.6	7
Wildlife Ecology	3	18.8	16

Table 9

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 18

Discipline	Frequency	Percent	Total Respondents
Agriculture Economics	1	20.0	5
Art	1	9.1	11
Botany	3	21.4	14
Chemistry	2	14.3	14
Civil Engineering	1	7.7	13
Community Leadership	1	12.5	8
Economics	1	10.0	10
Education	1	5.6	18
Environmental Design	1	25.0	4
Food Science	1	7.1	13
Geography	2	15.4	13
Geology	1	9.1	11
Guidance and Counseling	2	28.6	7
Hydrology	1	20.0	5
Journalism	1	16.7	6
Mass Communications	2	28.6	7
Meteorology	1	20.0	5
Natural Resources Conservation	1	10.0	10
Oncology	1	14.3	7
Parks and Recreation Management	1	25.0	4
Political Science	1	10.0	10
Public Health	2	28.6	7
Social Work	2	28.6	7
Urban and Regional Planning	2	25.0	8
Veterinary Science	1	14.3	7
Wildlife Ecology	1	6.3	16

Table 10

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 21

Discipline	Frequency	Percent	Total Respondents
Art	1	9.1	11
Botany	1	7.1	14
Chemistry	2	14.3	14
Civil Engineering	1	7.7	13
Computer Sciences	2	33.3	6
Education	1	5.6	18
Geography	5	38.5	13
Hydrology	1	20.0	5
Mass Communications	1	14.3	7
Natural Resources Conservation	4	40.0	10
Oncology	2	28.6	7
Parks and Recreation Management	1	25.0	4
Political Science	2	20.0	10
Public Health	1	7.7	13
Social Work	1	14.3	7
Sociology	1	8.3	12
Soils	1	11.1	9
Urban and Regional Planning	1	12.5	8
Wildlife Ecology	8	50.0	16

Table 11

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 24

Discipline	Frequency	Percent	Total Respondents
Agriculture	1	20.0	5
Art	1	9.1	11
Botany	2	14.3	14
Chemistry	1	7.1	14
Commerce	1	16.7	6
Community Leadership	1	12.5	8
Education	2	11.1	18
Food Science	1	7.7	13
Geography	2	15.4	13
Hydrology	2	40.0	5
Landscape Architecture	1	11.1	9
Meteorology	1	25.0	4
Music	1	14.3	7
Natural Resources Conservation	2	20.0	10
Oncology	1	14.3	7
Physics	1	8.3	12
Political Science	3	30.0	10
Social Work	2	28.6	7
Sociology	3	25.0	12
Theater Production	2	20.0	10
Urban and Regional Planning	3	37.5	8
Veterinary Science	1	14.3	7

Table 12

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 25

Discipline	Frequency	Percent	Total Respondents
Art	2	18.2	11
Botany	2	14.3	14
Chemistry	1	7.1	14
Civil Engineering	3	23.0	13
Commerce	3	50.0	6
Community Leadership	2	25.0	8
Computer Sciences	1	12.5	8
Education	1	5.6	18
Environmental Design	1	25.0	4
Food Science	1	7.6	13
Geography	4	30.8	13
Hydrology	1	20.0	5
Journalism	2	33.3	6
Landscape Architecture	1	11.1	9
Mass Communications	1	14.3	7
Medical Education	2	28.6	7
Meteorology	1	20.0	5
Natural Resources Conservation	1	10.0	10
Oncology	1	14.3	7
Pharmacology	1	25.0	4
Physics	1	8.3	12
Political Science	1	10.0	10
Public Health	1	14.3	7
Recreation Education	3	23.0	13
Sociology	1	8.3	12
Soils	1	11.1	9
Theater Production	1	10.0	10
Urban and Regional Planning	1	12.5	8
Veterinary Science	1	14.3	7
Wildlife Ecology	3	18.8	16

Table 13

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 43

Discipline	Frequency	Percent	Total Respondents
Agriculture	1	20.0	5
Art	2	18.2	11
Botany	2	14.3	14
Chemistry	3	21.4	14
Commerce	1	16.7	6
Community Leadership	1	12.5	8
Computer Science	1	16.7	6
Economics	2	20.0	10
Education	2	11.1	18
Environmental Design	1	25.0	4
Food Science	4	30.8	13
Geography	2	16.7	12
Guidance and Counseling	2	28.6	7
Hydrology	1	20.0	5
Journalism	1	16.7	6
Landscape Architecture	1	11.1	9
Mass Communications	2	28.6	7
Medical Education	2	28.6	7
Music	1	14.3	7
Natural Resources Conservation	2	20.0	10
Oncology	1	14.3	7
Physics	1	8.3	12
Political Science	1	10.0	10
Recreation Education	1	7.7	13
Social Work	1	14.3	7
Sociology	1	8.3	12
Soils	1	11.1	9
Theater Production	2	20.0	10
Urban and Regional Planning	2	25.0	8
Veterinary Science	2	28.6	7

Table 14

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 45

Discipline	Frequency	Percent	Total Respondents
Agriculture	1	20.0	5
Agriculture Economics	1	20.0	5
Art	3	27.3	11
Botany	4	28.6	14
Chemistry	1	7.1	14
Community Leadership	1	12.5	8
Computer Sciences	1	16.7	6
Economics	1	10.0	10
Environmental Design	2	50.0	4
Food Science	1	7.6	13
Geography	3	25.0	12
Geology	1	9.1	11
Guidance and Counseling	3	42.9	7
Journalism	2	33.3	6
Landscape Architecture	1	11.1	9
Mass Communications	2	28.6	7
Medical Education	1	14.3	7
Music	2	28.6	7
Natural Resources Conservation	1	10.0	10
Oncology	2	28.6	7
Physics	1	8.3	12
Political Science	4	40.0	10
Public Health	1	14.3	7
Social Work	2	28.6	7
Sociology	1	8.3	12
Soils	1	11.1	9
Theater Production	2	20.0	10
Urban and Regional Planning	3	37.5	8
Veterinary Science	1	14.3	7
Wildlife Ecology	3	18.8	16

Table 15

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 46

Discipline	Frequency	Percent	Total Respondents
Agriculture	2	40.0	5
Agriculture Economics	2	40.0	5
Art	2	18.2	11
Botany	7	50.0	14
Commerce	2	33.3	6
Community Leadership	3	37.5	8
Computer Sciences	1	16.7	6
Education	1	5.6	18
Geography	1	8.3	12
Geology	1	9.1	11
Guidance and Counseling	1	14.3	7
Journalism	1	16.7	6
Landscape Architecture	2	22.2	9
Mass Communications	2	28.6	7
Medical Education	1	14.3	7
Music	2	28.6	7
Natural Resources Conservation	1	10.0	10
Oncology	1	14.3	7
Physics	2	16.7	12
Political Science	6	60.0	10
Public Health	1	14.3	7
Recreation Education	1	7.7	13
Social Work	3	42.9	7
Sociology	2	16.7	12
Theater Production	2	20.0	10
Urban and Regional Planning	1	12.5	8
Veterinary Science	2	28.6	7
Wildlife Ecology	2	6.3	16

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Table 16

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 53

Discipline	Frequency	Percent	Total Respondents
Agriculture	2	40.0	5
Art	1	9.1	11
Botany	6	42.9	14
Chemistry	2	14.3	14
Civil Engineering	4	30.8	13
Commerce	2	33.3	6
Economics	1	10.0	10
Education	1	5.6	18
Genetics	1	14.3	7
Geography	3	25.0	12
Geology	3	9.1	11
Hydrology	2	40.0	5
Journalism	1	16.7	6
Landscape Architecture	2	22.2	9
Mass Communications	1	14.2	7
Medical Education	2	28.6	7
Meteorology	1	20.0	5
Natural Resources Conservation	4	40.0	10
Oncology	2	28.6	7
Physics	3	25.0	12
Political Science	2	20.0	10
Public Health	1	14.3	7
Social Work	3	42.9	7
Sociology	2	16.7	12
Urban and Regional Planning	2	25.0	8
Wildlife Ecology	5	31.3	16

Table 17

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 54

Discipline	Frequency	Percent	Total Respondents
Art	2	18.2	11
Botany	2	14.3	14
Chemistry	1	7.1	14
Civil Engineering	3	23.0	13
Community Leadership	1	12.5	8
Computer Sciences	2	33.3	6
Economics	2	20.0	10
Education	1	5.6	18
Food Science	3	23.1	13
Genetics	2	28.6	7
Geography	4	33.3	12
Geology	1	9.1	11
Guidance and Counseling	1	14.3	7
Hydrology	1	20.0	5
Journalism	1	16.7	6
Landscape Architecture	2	22.2	9
Mass Communications	1	14.3	7
Medical Education	4	57.1	7
Music	3	42.9	7
Natural Resources Conservation	5	50.0	10
Oncology	3	42.9	7
Political Science	4	40.0	10
Public Health	1	14.3	7
Rural Sociology	1	33.3	3
Social Work	1	14.3	7
Sociology	4	33.3	12
Theater Production	1	10.0	10
Urban and Regional Planning	2	25.0	8
Veterinary Science	1	14.3	7
Wildlife Ecology	3	18.8	16

Table 18

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 55

Discipline	Frequency	Percent	Total Respondents
Agriculture Economics	1	20.0	5
Art	1	9.1	11
Botany	3	21.4	14
Chemistry	2	14.3	14
Civil Engineering	2	15.4	13
Commerce	2	33.3	6
Community Leadership	1	12.5	8
Computer Sciences	2	33.3	6
Economics	1	10.0	10
Education	2	11.1	18
Food Science	2	15.4	13
Genetics	1	14.3	7
Geography	4	33.3	12
Geology	3	27.3	11
Hydrology	1	20.0	5
Journalism	1	16.7	6
Landscape Architecture	2	22.2	9
Mass Communications	1	14.3	7
Medical Education	1	14.3	7
Music	2	28.6	7
Natural Resources Conservation	2	20.0	10
Oncology	3	42.9	7
Pharmacology	1	25.0	4
Political Science	4	40.0	10
Public Health	1	14.3	7
Recreation Education	1	7.6	13
Social Work	1	7.6	7
Sociology	5	41.7	12
Theater Production	2	20.0	10
Urban and Regional Planning	1	12.5	8
Veterinary Science	1	14.3	7
Wildlife Ecology	1	6.3	16

Table 19

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 65

Discipline	Frequency	Percent	Total Respondents
Agriculture	2	40.0	5
Agriculture Economics	2	40.0	5
Art	4	36.4	11
Botany	5	35.7	14
Chemistry	4	28.6	14
Civil Engineering	4	30.8	13
Commerce	2	33.3	6
Community Leadership	1	12.5	8
Computer Sciences	1	16.7	6
Economics	2	20.0	10
Education	3	16.7	18
Environmental Design	1	25.0	4
Food Science	3	23.1	13
Genetics	1	14.3	7
Geography	5	4.17	12
Guidance and Counseling	1	14.3	7
Hydrology	2	40.0	5
Journalism	1	16.7	6
Landscape Architecture	1	11.1	9
Mass Communications	2	28.6	7
Medical Education	3	42.9	7
Music	2	28.6	7
Natural Resources Conservation	5	50.0	10
Oncology	2	28.6	7
Political Science	2	20.0	10
Public Health	3	42.9	7
Recreation Education	3	23.1	13
Rural Sociology	1	33.3	3
Social Work	5	7.14	7
Sociology	4	33.3	12
Soils	3	33.3	9
Theater Production	3	30.0	10
Urban and Regional Planning	4	50.0	8
Veterinary Science	3	42.9	7
Wildlife Ecology	3	18.8	16

Table 20

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 77

Discipline	Frequency	Percent	Total Respondents
Agriculture Economics	2	40.0	5
Art	2	18.2	11
Botany	4	28.6	14
Chemistry	2	14.3	14
Commerce	1	16.7	6
Community Leadership	1	12.5	8
Economics	2	20.0	10
Education	2	11.1	18
Geography	2	16.7	12
Journalism	1	16.7	6
Mass Communications	2	28.6	7
Medical Education	2	28.6	7
Meteorology	1	20.0	5
Natural Resources Conservation	3	30.0	10
Oncology	2	28.6	7
Political Science	6	60.0	10
Public Health	2	28.6	7
Sociology	3	25.0	12
Soils	1	11.1	9
Theater Production	2	20.0	10
Urban and Regional Planning	2	12.5	8
Veterinary Science	1	14.3	7
Wildlife Ecology	1	6.3	16

Table 21

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 94

Discipline	Frequency	Percent	Total Respondents
Agriculture Economics	2	40.0	5
Art	1	9.1	11
Botany	3	21.4	14
Chemistry	3	21.4	14
Civil Engineering	3	23.1	13
Commerce	1	16.7	6
Economics	1	10.0	10
Education	4	22.2	18
Food Science	1	7.7	13
Genetics	1	14.3	7
Geography	3	25.0	12
Geology	5	45.5	11
Hydrology	1	20.0	5
Landscape Architecture	2	22.2	9
Mass Communications	1	14.3	7
Medical Education	1	14.3	7
Natural Resources Conservation	1	10.0	10
Oncology	1	14.3	7
Political Science	1	10.0	10
Public Health	2	28.6	7
Social Work	2	28.6	7
Sociology	1	8.3	12
Soils	2	22.2	9
Theater Production	1	10.0	10
Urban and Regional Planning	1	12.5	8
Veterinary Science	1	14.3	7
Wildlife Ecology	2	12.5	16

Table 22

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 100

Discipline	Frequency	Percent	Total Respondents
Agriculture	1	20.0	5
Agriculture Economics	2	40.0	5
Botany	3	21.4	14
Chemistry	1	7.1	14
Civil Engineering	1	7.6	13
Commerce	1	16.7	6
Community Leadership	1	12.5	8
Computer Sciences	2	33.3	6
Economics	2	20.0	10
Education	3	16.7	18
Food Science	1	7.7	13
Genetics	1	14.3	7
Geography	3	25.0	12
Geology	2	18.2	11
Guidance and Counseling	1	14.3	7
Meteorology	1	20.0	5
Natural Resources Conservation	1	10.0	10
Oncology	2	28.6	7
Political Science	3	30.0	10
Public Health	1	14.3	7
Recreation Education	1	7.7	13
Rural Sociology	2	15.4	3
Social Work	3	42.9	7
Sociology	2	25.0	12
Urban and Regional Planning	2	25.0	8
Veterinary Science	2	28.6	7
Wildlife Ecology	1	6.3	16

Table 23

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 111

Discipline	Frequency	Percent	Total Respondents
Agriculture	1	20.0	5
Agriculture Economics	1	20.0	5
Art	1	9.1	11
Botany	2	14.2	14
Chemistry	2	14.2	14
Civil Engineering	2	15.4	13
Economics	2	20.0	10
Education	6	33.3	18
Food Science	3	23.0	13
Genetics	1	14.3	7
Geography	3	25.0	12
Geology	2	18.2	11
Hydrology	1	20.0	5
Journalism	1	16.7	6
Mass Communications	1	14.3	7
Music	1	14.3	7
Natural Resources Conservation	2	20.0	10
Oncology	2	28.6	7
Political Science	4	40.0	10
Public Health	1	14.3	7
Recreation Education	2	15.4	13
Sociology	1	8.3	12
Urban and Regional Planning	2	25.0	8
Veterinary Science	1	14.3	7
Wildlife Ecology	2	12.5	16

Table 24

Distribution by Discipline of the Respondents Indicating "Unacceptable" for Concept 112

Discipline	Frequency	Percent	Total Respondents
Agriculture	2	40.0	5
Agriculture Economics	1	20.0	5
Art	1	9.1	11
Civil Engineering	2	15.4	13
Computer Sciences	1	16.7	6
Economics	2	20.0	10
Education	1	5.6	18
Food Science	1	7.6	13
Genetics	2	28.6	7
Geography	1	8.3	12
Geology	2	18.2	11
Hydrology	1	20.0	5
Landscape Architecture	1	11.1	9
Mass Communications	1	14.3	7
Medical Education	1	14.3	7
Meteorology	1	20.0	5
Music	2	28.6	7
Natural Resources Conservation	2	20.0	10
Oncology	1	14.3	7
Physics	2	16.6	12
Political Science	1	10.0	10
Public Health	2	28.6	7
Recreation Education	1	7.7	13
Soils	1	11.1	9
Theater Production	1	10.0	10
Urban and Regional Planning	1	12.5	8
Wildlife Ecology	1	6.3	16

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Another speculated cause of rejection of a particular concept was that scholars representing a given ecological region might, because of a regional orientation, not assess high value to the concept. A tabulation of the rejected concepts by ecological regions, Tables 25 to 41, reveals little to support this speculation. While no clear pattern of response is in evidence, there appears to be a very slight indication that respondents representing the Hemlock-Hardwood Forest region might have a tendency to reject more concepts and respondents representing the Northern Desert region might have a tendency to reject fewer concepts.

A third reasonable cause for rejection of a given concept that emerged was the possibility of multiple interpretations or vagueness of meaning of the concept statements (see Table 7). Some examples are:

Concept 15—culture is equated with biological diversity.
Concept 18—fails to clarify that energy transfer is a consequence of the metabolic efficiency of organisms involved.
Concept 21—does not adequately define the term "level."
Concept 24—an editorial error was responsible for the use of the term "substance" when the term "substitute" should have been used.
Concept 25—a contradiction exists between the phrase "rate of renewal" and the definition of the term "exhaustible."
Concept 43—individuals, population, and species are equated.
Concept 45—confusion exists in definition of the term "stockpiled."
Concept 46—confusion exists in definition of the term "stockpiled."
Concept 53—might be interpreted to be contradictory because of the usage assigned to the terms "growth" and "constant."
Concept 54—confusion exists in definitions of the terms "excessive" and "optimum."
Concept 55—definitions of the terms "satisfactory" and "optimum" are obscure.
Concept 65—mineral resources are equated with the cultural pyramid.
Concept 77—production and benefits are equated.
Concept 94—contains a typographical error in that the terms "Man to" should have been used in place of the term "nor."
Concept 100—terminology used is poorly defined.
Concept 111—poor definition of terms.
Concept 112—the phrase "countervailing power structures" is not defined.

Comments in relation to the above concepts were often noted by the respondents indicating some of the above possible causes for rejection.

The variability in the ratings assigned to the concepts indicates that some individual differences of opinion and interpretation exists, but no clear bias is evident due to either professional area or ecological region. It can therefore be suggested that the 111 acceptable concepts included in the taxonomic list are reasonably well agreed upon.

Table 25

Distribution of Unacceptable Response to Individual Concepts by Ecological Region

Concept	Rocky Mountain Forest (N = 62)*		Hemlock-Hardwood Forest (N = 74)		Northern Desert (N = 61)		Deciduous Forest (N = 49)		Grassland (N = 66)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
15	3	4.8	12	16.2	4	6.5	6	12.2	6	9.1
18	9	14.5	7	9.5	2	3.3	9	18.4	5	7.6
21	4	6.5	9	12.7	3	4.9	3	6.1	12	18.2
24	5	8.1	5	6.8	7	11.5	5	10.2	7	10.6
25	10	16.1	11	14.9	4	6.6	6	12.2	9	9.1
43	12	19.4	11	14.9	7	11.5	3	6.1	5	7.6
45	14	22.6	10	13.6	5	8.2	9	18.4	10	15.2
46	12	19.4	15	20.3	4	6.6	11	22.4	7	10.6
53	10	16.1	15	20.3	4	6.6	10	20.4	13	19.7
54	9	14.5	16	21.6	10	16.4	10	20.4	13	19.7
55	9	14.5	17	22.9	10	16.4	8	16.3	10	15.2
65	11	17.7	25	33.8	16	26.2	13	26.5	17	25.8
77	8	12.9	9	12.7	4	6.5	9	18.4	11	16.7
94	8	12.9	16	21.6	4	6.5	5	10.2	10	15.2
100	11	17.7	8	10.8	6	9.8	6	12.2	12	18.2
111	5	8.1	10	13.6	7	11.5	10	20.4	10	15.2
112	3	4.8	11	14.9	9	14.8	5	10.2	4	6.1

*N = number of respondents

REFERENCES

Allen, Shirley W. 1955. Conserving natural resources. McGraw-Hill Book Company, Inc., New York.

American Association of School Administrators. 1951. Conservation education in American schools. 29th Yearbook, American Association of School Administrators, Washington, D. C.

Baker, Frank B. & Martin, Thomas J. FORTAP, A Fortran test analysis package. Madison, Wis.: Laboratory of Experimental Design, Wisconsin Research and Development Center for Cognitive Learning, 1968.

Blanchet, Waldo E. 1946. A basis for the selection of course content for survey courses in the natural sciences. Unpublished Ph. D. Dissertation, University of Michigan, Ann Arbor.

Brandwein, Paul F. 1966. Origins of public policy and practice in conservation: early education and the conservation of sanative environments. In F. Fraser Darling and John P. Milton (Editors), Future Environments of North America. The Natural History Press, Garden City, New Jersey.

Brennan, Matthew I. (Editor). 1968. People and their environment. J. G. Ferguson Publishing Co., Chicago.

Cain, Stanley A. 1967. Human ecology. The Science Teacher, 34: 13-17.

Caldwell, Loren T. 1955. Determination of earth science principles desirable for inclusion in the science program of general education in the secondary school. Science Education 39: 196-213.

Chapman, Oscar Littleton. Geography and natural resources in the development of the American way of life. Lecture, University of Wisconsin, Madison. 1952.

Comstock, Anna Botsford. 1911. Handbook of nature study. Comstock Publishing Company, Inc., Ithaca, New York.

Craig, Gerald S. 1927. Certain techniques used in developing a course of study for the Horace Mann Elementary School. Bureau of Publications, Teachers College, Columbia University, New York.

_____. 1944. Science in childhood education. Bureau of Publications, Teachers College, Columbia University, New York.

Curtis, Francis D. 1924. Some values derived from extensive reading in general science. Teachers College Contributions to Education, Teachers College, Columbia University, New York.

Dasmann, Raymond F. A different kind of country. The Macmillar Company, New York, 1968,a.

_____. 1968, b. Environmental conservation. John Wiley and Sons, Inc., New York.

Dewey, John. 1916. Democracy and education. The Macmillan Company, New York.

Dice, Lee R. 1955. Man's nature and nature's man. University of Michigan Press, Ann Arbor.

Donnelly, Rose A. 1957. A study of the conservation ideas of 282 urban children. Unpublished Ph. D. Dissertation, Teachers College, Columbia University, New York.

Glidden, Harley F. 1953. The identification and evaluation of principles of soil and water conservation for inclusion in the secondary school curriculum. Unpublished Ph. D. Dissertation, University of Nebraska, Lincoln.

Graff, George P. 1962. Conservation understandings in the intermediate grades. Unpublished Ph. D. Dissertation, The Ohio State University, Columbus.

Goodenough, Ward Hunt. 1966. Cooperation in change: an anthropological approach to community development. John Wiley and Sons, Inc., New York.

Hanselman, David L. 1963. Interdepartmental teaching of conservation at The Ohio State University. The Natural Resources Institute, The Ohio State University, Columbus.

Hone, Elizabeth. 1959. An analysis of conservation education in curriculums for grades K-12. Unpublished Ph. D. Dissertation, University of Southern California, Los Angeles.

Irish, E. Eugene. 1953. A determination of materials dealing with soil conservation and suitable for integration into courses of high school science for general education. Science Education 37: 84-99.

Jackman, W. S. 1904. Nature study; the third yearbook of the National Society of the Scientific Study of Education. The National Society for the Scientific Study of Education, Chicago.

Kenyon, Raymond G. 1965. A nine year comparative study of the status of conservation education in public elementary schools of New York State from 1955 to 1964. Unpublished Ph. D. Dissertation, State University of New York, Buffalo.

Lively, Chares E. and Preiss, Jack J. 1957. Conservation education in American colleges. Sponsored by the Conservation Foundation, The Ronald Press, New York.

Martin, William E. 1944. A determination of the principles of the biological sciences of importance for general education. Unpublished Ph. D. Dissertation, University of Michigan, Ann Arbor.

Menesini, Mario M. 1968. National environmental education development. National Park Service, Washington, D. C.

Miles, Vaden W. 1949. A determination of principles and experiments for an integrated course of physical science for high school. Science Education 33: 147-152, 198-205.

National Society for the Scientific Study of Education. 1904. Nature study, the third yearbook of the National Society for the Scientific Study of Education. The National Society for the Scientific Study of Education, Chicago.

National Society for the Study of Education. 1947. Science education in American schools. Forty-sixth yearbook, Part I. University of Chicago Press (Distributor), Chicago.

Potter, Van R. 1967. The role of the individual in modern society. In Robert B. Boyd (Editor), Concepts of productive living. University Extension, Madison.

Robertson, Martin L. 1935. The selection of science principles suitable as goals of instruction in the elementary school. Science Education 19: 65-71.

Schoenfeld, Clay, 1968, a. Educating the public in natural resources. Journal of Soil and Water Conservation. Vol. 23, No. 6, November-December.

Schoenfeld, Clarence A. 1968, b. Environmental education and the university. Educational Record, Summer: 305-310.

Sherman, Robert C. 1950. The conservation attitudes and information possessed by elementary school teachers in training. Unpublished Ph. D. Dissertation, University of Missouri, Columbia.

Stapp, William B. 1965. Integrating conservation and outdoor education into the curriculum (K-12). Burgess Publishing Company, Minneapolis.

Stapp, William B., et al. 1969. The concept of environmental education. Environmental Education 1:30.

Trainor, Vincent F. 1964. A determination of science concepts that should be taught in the junior high school. Unpublished Ph. D. Dissertation, The University of Connecticut, Storrs.

Transeau, E. N. 1948. Vegetation zones of North America. Lecture, The Ohio State University, Columbus.

Visher, Halene Hatcher. 1960. A determination of conservation principles and concepts desirable for use in the secondary schools. Unpublished Ph. D. Dissertation, University of Indiana, Bloomington.

Weaver, Richard L. 1955. Handbook for teaching conservation and resource use. National Conservation Committee of the National Association of Biology Teachers, The Interstate Printers and Publishers, Inc., Danville, Illinois.

White, Roy C. 1967. A study associating selected conservation understandings with available community resources for grades four through twelve. Unpublished Ph. D. Dissertation, University of Montana, Missoula.

Wise, Harold E. 1941. A determination of the relative importance of principles of physical science for general education. Science Education 25:7.

Yambert, Paul Abt. 1961. A principle and concept perspective of conservation. Unpublished Ph. D. Dissertation, University of Michigan, Ann Arbor.

APPENDIX

WISCONSIN RESEARCH AND DEVELOPMENT CENTER
FOR COGNITIVE LEARNING
University of Wisconsin
1404 Regent Street
Madison, Wisconsin 53706

CONCEPTS FOR ENVIRONMENTAL MANAGEMENT

_____
Name

_____
Position

_____
Professional Field

_____
Specialization

D I R E C T I O N S

Enclosed is a list of concepts related to environmental management for possible inclusion in school curricula. As an indication of their relative importance, we are requesting your reaction to each concept. Please indicate your opinion of the worth of each concept by placing a check in the appropriate space. Comments may be noted under each item.

Sample Entry

0. Man is a coexistant with the environment.

X Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

Explanation:

In this example, the respondent thought the statement to be acceptable and of "Essential" importance thereby marking an X in the appropriate box. No comment was added in this case.

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1. Living things are interdependent with each other and their environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

2. Natural resources are interdependent and the use or misuse of one will affect others.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

3. The natural environment is irreplaceable.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

4. Man has been a factor affecting plant and animal succession and environmental processes.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

5. The interaction of environmental and biological factors determines the size and range of species and populations.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

6. Energy is supplied to an ecosystem by the activities of green plants.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

7. The earth and life on it are greatly affected by the atmosphere.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

8. Pollutants and contaminants are produced by natural and man-made processes.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

9. Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radio-active wastes, and heat, is important if the well-being of man and the environment is to be preserved.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

10. An organism is the product of its heredity and environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

11. All living things, including man, are continually evolving.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

12. Man is influenced by many of the same hereditary and environmental factors that affect other organisms and their populations.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

13. The form of life present depends upon the coincidence of the life needs and their availability in an environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

14. The rate of change in an environment may exceed the rate of organism adaptation.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

15. A diverse biological community or culture perpetuates diversity within the gene pool.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

16. Organisms and environments are in constant change.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

17. Biological systems are described as dynamic because the materials and energy involved are parts of continuous cycles; inorganic materials and energy become part of organic materials and are subsequently broken down into simpler substances and energy as a result of the operation of organic systems.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

18. At each successively higher level on an energy pyramid, the organic mass is reduced due to metabolic and energy transfer losses occurring at each exchange.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

19. Succession is the gradual and continuous replacement of one kind of plant or animal complex by another and is characterized by gradual changes in species composition.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

20. In any environment, one component like space, water, air or food may become a limiting factor.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

21. The carrying capacity of an ecosystem is the level at which a population can be sustained at an acceptable level of nutrition.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

22. Most resources are vulnerable to depletion in quantity, quality, or both.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

23. The nonrenewable resource base is considered finite.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

24. The rate of use of a nonrenewable natural resource is dependent upon supply and demand, availability of substances, and technology.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

25. The rate of renewal of an exhaustible natural resource is usually extremely slow.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable.

26. The renewable resource base can be extended by reproduction, growth, and management.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

27. Geological processes like erosion and deposition modify the landscape.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable.

28. The economy of a region depends on the utilization of its natural, human, and cultural resources and technologies over time.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

29. Natural resources, water and minerals in particular, are unequally distributed with respect to land areas and political boundaries.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

30. Minerals are nonrenewable resources.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

31. Mineral conservation involves the utilization of all known methods of using the minerals of the earth's crust that will cause them to serve more people for a longer time.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

32. Soil is classified as a renewable resource, but, because it may take a few years to thousands of years to be "renewed," it is more practically termed a depletable resource.

__Essential __Highly Desirable _Desirable __Satisfactory __Unacceptable

33. Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of people.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

34. Soil productivity can be maintained by utilizing known agronomic, mechanical, and chemical processes.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

35. Water is a reusable and transient resource, but the available quantity may be reduced or quality impaired.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

36. The amount of precipitation that becomes available for use by man varies with topography, land use, and applied management practices.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

37. Water supplies, both in quantity and quality, are important to all levels of living.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

38. Plants are renewable resources.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

39. Green plants are the ultimate sources of food, clothing, shelter, and energy in most societies.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

40. Animal populations are renewable resources.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

41. Wildlife is considered to be a public resource.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

42. Management of habitat is considered to be an effective technique of wildlife management when the desire is to increase numbers of particular populations.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

43. A rapid turnover of individuals making up a population of most wildlife species exists whether or not the species are exploited.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

44. Wildlife populations are important economically, esthetically, and biologically.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

45. Nonmigratory small game wildlife populations cannot be stock-piled; when hunting mortality replaces natural mortality--the resource is utilized.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

46. Migratory wildlife populations can be stockpiled for short periods of time.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

47. Hunting regulations are useful in maintaining and restoring populations as well as in distributing the game harvest.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

48. Wildlife refuges, undisturbed natural areas, and preserves may be of value in protecting endangered species and perpetuating the gene pool.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

49. Increasing human populations, rising levels of living, and the resultant demands for greater industrial and agricultural productivity promote increasing environmental contamination.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

50. The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions, and lifeways that are transmitted to its progeny.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

51. Man has psychobiological and biosocial needs.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

52. Man is a high animal form because of his ability to reason.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

53. Man's biological life requirements for growth and development are relatively constant.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

54. Reduction of environmental stresses from excessive to optimum levels result in a feeling of well being.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

55. A satisfactory level of physical, psychological and social health for man depends upon an optimum level of environmental stress.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

56. Environmental management involves the application of knowledge from many different disciplines.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

57. Natural resources affect and are affected by the material welfare of a culture and directly or indirectly by philosophy, religion, government, and the arts.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

58. The political and economic strength of a country is, in part, dependent upon its access to domestic and foreign resources and international relationships.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

59. The relationships between man and the natural environment are mediated by his culture.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

60. Social and technological changes alter the interrelationships, importance, and uses for natural resources.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

61. The distribution or location of resources in relation to population, technological, and economic factors are critical to problems of resource conservation and use.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

62. Modern man affects the structure of his environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

63. Resource depletion can be slowed by the development and adoption of alternatives.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

64. Supply and demand, in relation to values held by society, determine what is a resource and its economic values.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

65. Mineral resources form the base of the cultural pyramid for modern man.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

66. Conservation policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

67. The more efficient use of some resources is the result of technical and marketing improvements.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

68. Man's need for food, fiber, and minerals increases as populations expand and levels of consumption rise.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

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69. Increased population mobility is changing the nature of the demands upon some resources.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

70. As populations increase competition for the use of water increases resulting in a need for establishing water use priorities.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

71. Multiple use is a practice in which a given land area functions in two or more compatible ways.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

72. Zoning is a practice in which land uses are prescribed based upon value judgments regarding the needs of society.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

73. Conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

74. Choices between needs (essentials) and wants or desires (nonessentials) are often in conflict.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

75. Consumption practices are constantly being expanded by our ability to produce and create wants and markets, which affect the rate of resource use.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

76. Increasing population and per capita use of resources have brought changed land to man or resource to population ratios.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

77. An increase in input (capital, labor, resources) will produce a proportionate increase in production or benefits up to a limit defined as the margin of diminishing returns.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

78. The management of natural resources to meet the needs of successive generations demands long-range planning.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

79. Raw materials and energy supplies are generally obtained from those resources and places where they are available at least cost, usually in short economic terms.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

80. Goods and services are produced by the interaction of labor, capital, natural resources, and technology.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

81. Individuals tend to select short-term economic gains, often at the expense of greater long-term environmental benefits.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

82. Economic efficiency does not always result in conservation of a natural resource.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

83. Conventional benefit-cost analyses do not always result in sound conservation decisions.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

84. Ready transportation, growing interest, money surpluses, and increased leisure time combine to create heavy pressures on existing recreation facilities and demands for new ones.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

85. A sound natural resource policy is dependent upon a flexible political system, pragmatically appraising and reappraising policies and programs in terms of their effect upon the public interest and in light of scientific knowledge about the natural resources.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

86. A knowledge of the social, physical, and biological sciences and humanities are important for environmental understanding.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

87. Man has ability to manipulate and change the environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

88. Knowledge of the social structures, institutions, and culture of a society must be brought to bear on environmental considerations.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

89. Individuals perceive different self-roles depending upon their position in the social and environmental context.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

90. Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

91. The management of natural resources is culture bound.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

92. Policies, including natural resource policies, come about as the result of interacting social processes: science and technology, government operations, private interests, and public attitudes.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

93. A cultural and time lag exists between the development of knowledge in science and technology and application of that knowledge to resource and environmental problems.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

94. Science does not cause nor become independent of the natural environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

95. Human resources include the physical and mental abilities which man is endowed and the knowledge he has generated.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

96. Options available to future generations must not be foreclosed.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

97. Environmental management has effects on individuals and social institutions.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

98. Man has moral responsibility for his environmental decisions.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

99. Man is continually developing an ethical base for making value judgments.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

100. There are sensory prerequisites to the appreciation of the cultural heritage.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

101. Man has the capability of improving society through sociology, psychology, and science.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

102. There are certain risks taken, and limitations experienced, when manipulating the natural environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

103. Family planning and the limiting of family size are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

104. Man is developing the technical and sociological knowledge needed to control population growth, modify environments, and alter resource use patterns.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

105. Long-range planning for the use and allocation of natural and human resources is continually evolving.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

106. Historically, cultures with high technological development have used more natural resources than those with lower levels of technological development.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

107. As populations increase and/or as resource supplies decrease, the freedom of the individual to use the resources as he wishes decreases irrespective of the form of government.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

108. Public opinion constitutes a control over the use of conservation practices.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

109. Social values and mores influence personal conservation behavior.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

110. Conservation policies are often the result of group action.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

111. Government is the interaction of custom, rule, and law.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

112. Decisions in society are made through the interaction of countervailing power structures.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

113. A variety of institutional structures is involved in planning and managing the environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

114. In a democracy, a basic theory is that increasing restrictions on resource allocation and use are imposed by the consent or insistence of the people.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

115. Individual citizens should be stimulated to become well informed about resource issues, problems, management procedures, and ecological principles.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

116. Individual citizens should be stimulated to become active in the political process.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

117. Conservation responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

118. We have "legal" ownership of some resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the resource base.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

119. Man performs some tasks at a high physiological cost.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

120. Resources have a psychological impact on people.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

121. Emotional reactions can be elicited by exposure to physical objects and geometric forms.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

122. Architecture can be one of the positively persuasive influences in developing a congenial environment.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

123. An individual must develop his ability to perceive if he is to increase his awareness and develop environmental perspective.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

124. The need of man to turn inward for self renewal can be stimulated by his external esthetic experiences.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

125. Opportunities to experience and enjoy nature are psychologically rewarding to many and are important to mental health.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

126. Man has responsibility to develop an appreciation of and respect for the rights of others.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

127. Esthetic resources and recreational facilities of economic and non-economic value are becoming increasingly important in leisure-time activities.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

128. Outdoor recreation is an increasingly important part of our culture and our economy.

__Essential __Highly Desirable __Desirable __Satisfactory __Unacceptable

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